"A STUDY TO IDENTIFY PREVALENCE AND EFFECTIVENESS OF SENSORY INTEGRATION ON TOILET SKILL PROBLEMS AMONG SENSORY PROCESSING DISORDER"

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CERTIFICATE

This is to certify that the research work entitled **"A STUDY TO IDENTIFY PREVALENCE AND EFFECTIVENESS OF SENSORY INTEGRATION ON TOILET SKILL PROBLEMS AMONG SENSORY PROCESSING DISORDER"** carried out by **Reg. No.411513004**, towards partial fulfillment of the requirements of Master of Occupational Therapy (Advanced OT in Pediatrics), at KMCH College of Occupational Therapy (2015-2017), under the Tamil Nadu Dr. M.G.R. Medical University, Chennai.

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AKNOWLEDGEMENT

"He has made everything beautiful in its time; yet they cannot fathom what God has done from beginning to end"

- ***Ecclesiastes 3;11***

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ABSTRACT

Aim: To find the association between problems in toilet skills and sensory processing disorder by finding the prevalence of problems in toilet skills in children with sensory processing disorder and the effectiveness of sensory integration therapy for the improvement of toilet skills in children with SPD. And also to compare the effectiveness of sensory integration therapy with behavior modification for developing age appropriate toileting habits in children with SPD.

Methodology: A cross-sectional survey and quasi experimental pre-post test design was adopted for the study and consisted of 2 phases. In phase 1, 96 children with sensory processing disorder were selected based on the screening tool and were screened to find out the prevalence of toilet skill problems among them. In phase2 the study effectiveness of sensory integration therapy on toilet skill development was investigated on 22 children with toilet skill problems and sensory processing disorder. The base line and post test measurement were done using sensory profile, COPM and modified diet schedule. The control group underwent behavior modification therapy and experimental group in addition underwent SIT for 4 months. Both the groups also underwent conventional occupational therapy also.

Results: This study found out among 96 SPD children 68.75% had toilet skill problems. There were difference in sections, factors and quadrants in SP for children with and without toilet skill problems. In the phase 2 the result shows significant difference ($p < 0.05$) for experimental group had improvement in both sensory problems and toilet skill problems in followed by the SIT when compared to control group.

Conclusion: The study concluded that there is association between toilet skill problems and SPD. Sensory integration therapy also has an effect in toilet skill problems for children with SPD.As toilet scheduling is an important factor in development of appropriate toilet skills, treatment in combination with behavior modification and sensory integration therapy will be a better choice for children with SPD.

Keywords: Sensory processing disorder, sensory integration therapy, behavior modification, toilet skill problems.

INTRODUCTION

“Toileting is an important skill for daily life that has many social implications. In order for the child to achieve this important milestone, children and families need to establish a clear toileting routine. This will ensure a child has success in school and in social situations.”[1]

Occupational therapists are concerned with individuals´ abilities to engage in daily occupations. When a daily activity such as bowel management is problematic, participation in key occupations can be limited.[2] Activities of daily living are considered a central area of occupation and include all occupations related to self care. Bowel and bladder management as well as toilet hygiene are important activities of daily living.[1]

Awareness of the need to void the bowel and bladder depends on processing of associated sensory stimuli. Engaging in toileting tasks requires a person to tolerate and respond appropriately to a variety of sensory stimuli.[3] Potty training is very important in childhood development because it requires a significant amount of body awareness. Child should appropriately respond to the urge of defecation (that is when, where, how and feel finished). Sensory processing is a natural part of toilet training.

Sensory processing is a neurological process that organizes sensation form one’s body and the environment and makes it possible to use the body effectively within the environment. It is information processing.[4] *Sensory Processing Disorder (SPD, formerly known as "sensory integration* dysfunction") is a condition that exists when sensory signals *don't get organized* into appropriate responses. A. Jean Ayres, PhD, likened SPD to a neurological "traffic jam” that prevents certain parts of the brain from receiving the information needed to interpret sensory information correctly. According to an article published by university of California San Francisco(2013), Sensory processing disorders affect 5 to 16 percent of school-aged children. Sensory processing disorders (SPD) are more prevalent in children than autism and as common as attention deficit hyperactivity disorder, yet the condition receives far less attention partly because it’s never been recognized as a distinct disease.[5]

Interoception is our ability to sense what is going on inside our bodies internally. It includes sensations such as thirst, hunger, fatigue, pain, breathe, itchiness, nausea, temperature, etc. It also includes our sense of if we have a full bladder or bowel, and if we have "released" it [6].When a child's sensory systems are functioning appropriately, they are able to participate in activities of daily living such as potty-training. However, if the sensory systems are not integrated properly, toileting can become problematic.

In a recent study, it was found that more children with dysfunction elimination syndrome (53%) had SPD than was reported for general population[3]. In another study it was found out that a group of children (n=16) with retentive fecal incontinence presented with significantly more behaviors related to sensory over-responsivity than a group of typically developing children (n=27)[2].

Children with any type of gastrointestinal problem, including chronic constipation, had higher levels of sensory over-responsivity than children without such problems. The researchers found that sensory over-responsivity significantly contributed to the prediction of constipation, abdominal pain, nausea and bloating [7]. Sensations such as those relating to anal distension, to be without clothes or sit on a toilet or a hard potty and cold can make defensive tactical child within uncomfortable. The common position adopted for defecation stretches the skin of the anal area, which also it can cause discomfort[8].

The auditory startle reflex is considered a measure of hyperarousal [9]. Bakker and colleagues (2010) found that children with Irritable Bowel Syndrome (IBS) and functional abdominal pain syndrome demonstrated significantly greater auditory startle reflexes than a sample of typical children[10]. The sounds are often amplified in the bathrooms, which can be a factor for the adjuvant alert level is increased and thus be one of the factors responsible for the rejection of children with auditory hypersensitivity be in the bathroom[8].The authors consider that these results may provide evidence of a general hypersensitivity of the central nervous system among children with gastrointestinal disorders.

In most homes height of the toilet is not appropriate for young children and not having the feet in contact with the ground can cause insecurity and fear in children with vestibular hypersensitivity[8].

Need of the study

- Beaudry (2014) in her research showed children with retentive fecal incontinence had behaviors of sensory over responsiveness. And Mary R Pollock (2014) in a research found out that children with dysfunctional elimination syndrome also have sensory processing disorder.
- Though few studies had reported relationship between sensory processing disorder, sensory over responsivity and toilet skill problems, these studies are not adequate report to generalize the relationship between SPD and toilet skill problems. No research evidence for effectiveness of SI on toilet skills among SPD's
- The available studies on relation to sensory processing disorder and problems in toilet skills are case studies and no RCT's had published yet.
- Behavior techniques had already proven to be effective for toilet skills[11,12], but no studies had compared the effectiveness with sensory integration.
- There are several differences in toilet skills of western culture when compared with Indian
- Thus occupational performance (toileting independence) is same, performance components (musuloskeletal sensory &cognitive perceptual skills) require to complete the tasks are different. This asserts the need for studying toilet training in India.

RESEARCH QUESTION

- What is the association between problems in toilet skills and sensory processing disorder?
- Which is the most effective intervention for children with problems in toilet skills along with SPD, Sensory integration therapy or behavior modification?

AIM AND OBJECTIVES

AIM:

To find the association between problems in toilet skills and sensory processing disorder.

OBJECTIVES:

- To find the prevalence of problems in toilet skills in children with sensory processing disorder.
- To find out the effectiveness of sensory integration therapy for the improvement of toilet skills in children with SPD.
- To compare the effectiveness of sensory integration therapy with behavior modification for developing age appropriate toileting habits in children with SPD.

OPERATIONAL DEFINITIONS

- **Sensory processing disorder (SPD)**: A neurophysiologic condition in which sensory input either from the environment or from one's body is poorly detected, modulated, or interpreted and/or to which atypical responses are observed. (Miller 2013)
- **Problems in toilet skills**: include problems in regularity in defecation; relating to anal distension and fecal incontinence.
- **Sensory Integration intervention:** Aims to provide the child with various sensory experiences. These experiences are matched during therapy with a "just right" challenge, an activity that requires the child to give an adaptive response for toilets kill development.
- **Behavior modification therapy:** this is a systematic approach to alter the child's irregularity in defecation through environmental programming. In this positive traits are reinforced negative traits are ignored.
- **Conventional occupational therapy:** regular occupational therapy sessions.

RELATED LITERATURE

A child does not passively absorb whatever sensations come along. Rather the child selects those sensations that are most useful at the time and organizes them in a fashion that facilitates accomplishing goals. This is the process of sensory integration. When this process is going well, the child organizes a successful, goal directed action on the environment, which is called an adaptive response. When a child makes an adaptive response, he or she successfully meets some challenge presented in the environment. The adaptive response is possible because the brain has been able to efficiently organize incoming sensory information, which then provide basis for action[13].

Definition of Sensory processing disorder

The term *sensory integration dysfunction* was first used by Ayres in 1963[14]. On the basis of knowledge of neural science and detailed observation of child behavior, Ayres theorized that impaired sensory processing might result in various functional problems, which she labeled *sensory integration dysfunction*[15].

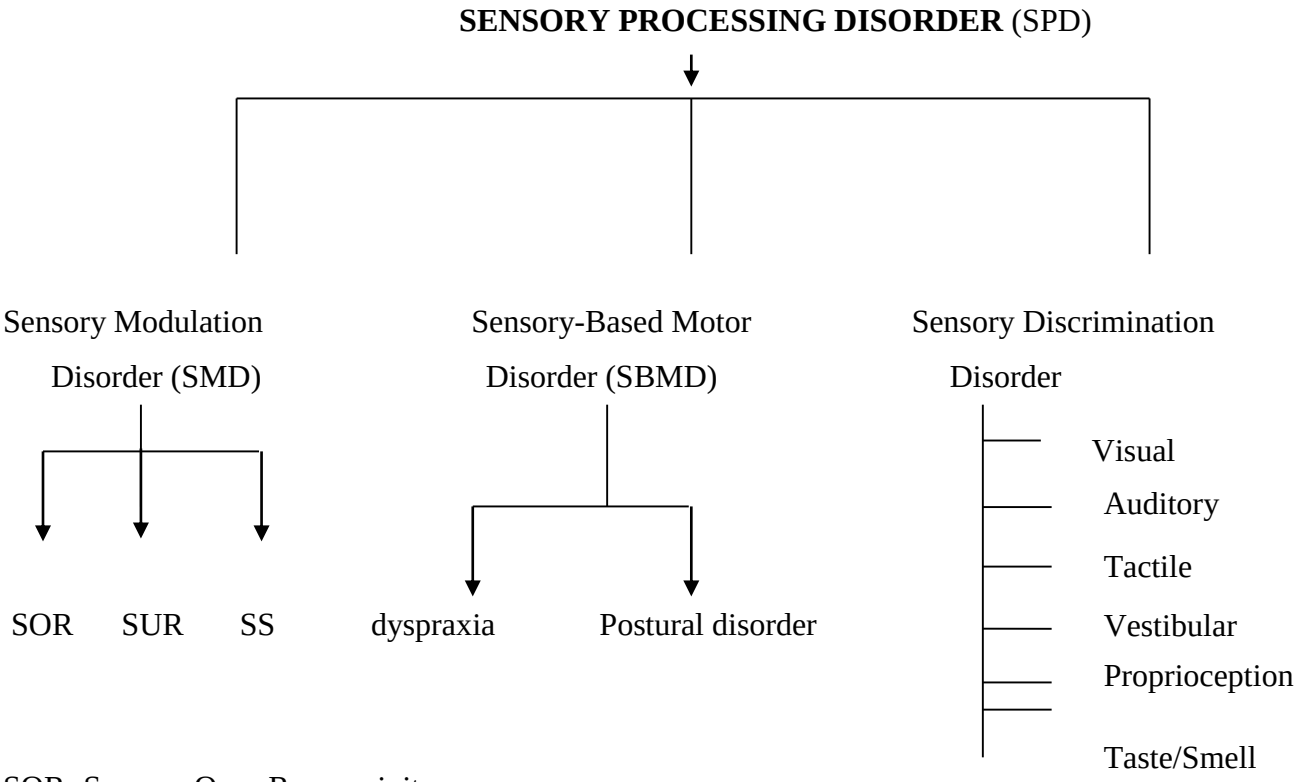
Sensory processing disorder is a neurophysiologic condition in which sensory input either from the environment or from one's body is poorly detected, modulated, or interpreted and/or to which atypical responses are observed[5].

Indicators of SPD include inappropriate or problematic motor, behavioral, attentional, or adaptive responses following or anticipating sensory stimulation. Sensory differences are only considered a "disorder" when they cause significant difficulties with daily routines and tasks (e.g. individual can't cope or compensate)[5].

Nosology of Sensory Processing Disorder[15]

According to the new nosology of sensory processing disorder by Miller(2007), it is divided into Sensory Modulation Disorder (SMD), Sensory Based Motor Disorder and Sensory Discrimination disorder. Sensory modulation disorder is again classified into Sensory Under Responsivity(SUR) , Sensory Over Responsivity(SUR), Sensory

Seeking(SS). Semsory based motor disorder as dyspraxia and postural disorder; Sensory discrimination disorder into visual, auditory, tactile, vestibular, proprioception and taste/smell.



SOR=Sensory Over-Responsivity

SUR=sensory UnderResponsivity

SS=Sensory Seeker/Craver

Sensory Modulation Disorder (SMD)

Sensory modulation occurs as the central nervous system regulates the neural messages about sensory stimuli. SMD results when a person has difficulty responding to sensory input with behavior that is graded relative to the degree, nature, or intensity of the sensory information.

SMD Subtype 1: Sensory Overresponsivity (SOR):

People with SOR respond to sensation faster, with more intensity, or for a longer duration than those with typical sensory responsivity. Overresponsivity may occur in only one sensory system (e.g., tactile defensiveness) or in multiple sensory systems (e.g., sensory defensiveness).

SMD Subtype 2: Sensory Underresponsivity (SUR):

People with SUR disregard, or do not respond to, sensory stimuli in their environments. They appear not to detect incoming sensory information. This lack of initial awareness may lead to apathy, lethargy, and a seeming lack of inner drive,to initiate socialization and exploration.

SMD Subtype 3: Sensory Seeking/ Craving (SS):

People with SS crave an unusual amount or type of sensory input and seem to have an insatiable desire for sensation. They energetically engage in actions that add more intense sensations to their bodies in many modalities (e.g., spicy food, loud noises, visually stimulating objects, constant spinning).

Sensory-Based Motor Disorder (SBMD)

People with SBMD have poor postural or volitional movement as a result of sensory problems. The two subtypes of SBMD are detailed below.

SBMD Subtype 1: Postural Disorder.

Postural disorder (PD) is difficulty stabilizing the body during movement or at rest to meet the demands of the environment or of a given motor task. PD is characterized by inappropriate muscle tension, hypotonic or hypertonic muscle tone, inadequate control of movement, or inadequate muscle contraction to achieve movement against resistance. Poor balance between flexion and extension of body parts, poor stability, poor righting and equilibrium reactions, poor weight shifting and trunk rotation, and poor ocular–motor control also may be noted.

SBMD Subtype 2: Dyspraxia.

Dyspraxia is an impaired ability to conceive of, plan, sequence, or execute novel actions. People appear awkward and poorly coordinated in gross, fine, or oral–motor areas.

Sensory Discrimination Disorder (SDD)

People with SDD have difficulty interpreting qualities of sensory stimuli and are unable to perceive similarities and differences among stimuli. They can perceive that stimuli are present and can regulate their response to stimuli but cannot tell precisely what or where the stimulus is. SDD can be observed in any sensory modality. A person with SDD may have different capacities in each modality (e.g., a visual or auditory discrimination disorder but good discrimination in all other modalities)[15].

Dunn's model of sensory processing:

Dunn[16,17] presented conceptual model that takes into account the potential roles of various neural processes in generating patterns of under-responsiveness and over responsiveness.

Responding / Self Regulation Strategies		
Thresholds/Reactivity	**Passive**	**Active**
High	Low registration	Sensory Seeking
Low	Sensory sensitivity	Sensory Avoiding

In her model, four main patterns represent individual differences in sensory responding: low registration, sensation seeking, sensitivity to stimuli and sensation avoiding. These patterns are hypothesized to emerge from individual differences in the neural processes of habituation, sensitization, threshold, and maintenance of homeostasis. The person who falls in the low registration quadrant of the model is underresponsive due to high threshold for reactivity and therefore needs to have a high level of intensity in environmental stimuli in order to notice and attend. The person who falls in the sensation seeking quadrant is also considered underresponsive with regard to high threshold but expresses this behaviorally by active seeking out intense sensory input. The sensory sensitivity and sensation avoiding quadrants represent overresponsive patterns. Individuals who fall in the sensory sensitivity quadrant have heightened awareness of, and are distracted by, sensory stimuli due to a low threshold, but they tend to passively cope with these sensations. In contrast, those who are sensation avoiding not only have heightened awareness of sensory stimuli but actively attempt to avoid the ordinary sensations that they experience as

noxious. One of the most important contributions of this model is that it can be used to consider what kinds of work and play or leisure environments present an optimal match for an individual's sensory modulation characteristics[17].

Toileting skills:

Independent toileting is an important self maintenance milestone, and its achievement varies widely among children. Self –sufficiency may determine participation in day care centers, school programs, recreational and community opportunities and secondary school vocational choices. Like other ADL tasks, toileting is a complex task requiring a thorough analysis of the child's capabilities influence performance skills and patterns. To begin to learn this task a child must be physically and physiologically ready. Also parents or caregivers need to be ready to devote the time and effort to toilet training the child. A communication system between caregivers and the child is essential[13].

Independence in toileting includes getting on and off the toilet, managing fasteners and clothing, cleansing after toileting, washing and drying hands efficiently without supervision. Children progress in sequence according to each child's unique pace of development.

Typical developmental sequence for toileting:

Approximate age (yr)		Toilet skill
1 year	-	Indicates discomfort when wet or soiled
	-	Has regular bowel movements
1.6 years	-	Sits on toilet when placed there and supervised(short time)
2 years	-	urinates regularly
2.6 years	-	achieves regulated toileting with occasional daytime accidents
	-	Rarely have bowel accidents
	-	tells someone that he or she needs to go to bathroom

	-	May need reminders to go to the toilet
3years	-	goes to the bathroom independently; seats himself or herself on toilet
	-	May need help for cleaning
	-	May need help with fasteners or difficulty clothing
4-5 years	-	Independent in toileting (e.g., cleaning, flushing, washing hands, managing clothing).[13]

Factors affecting toilet skills:

Relation between feeding and toileting skills:

Many children with SPD (sensory processing disorder) have poor eating habits due to oral sensitivity and eat only 'white foods' or similar low fiber foods. Refusal behavior is a common characteristic of children with Retentive Fecal Incontinence(RFI)[18-22] and children with feeding problems (for example food refusal or food selectivity).Sensory over-responsivity is well documented in children with feeding problems. [23-28]

Feeding disorders appear to have common etiological and maintenance factors with constipation[29].The classic study by Bellman documented a high prevalence of food refusal among children with fecal incontinence[30]. In a sample of institutionalized children and adults with intellectual disability, food refusal was also found to be more frequent in individuals with constipation than in a control group without constipation[31].A case report linking food refusal as a causal factor of RFI is also documented[32]. It was found that the cumulative incidence of constipation and feeding issues and/or food selectivity was significantly higher in children with autism relative to children in the control group. The authors of this study state that constipation and feeding issues often have a behavioral etiology, suggesting that a neurobehavioral etiology may account for the higher incidence of both of these conditions in children with autism. Sensory over-responsivity has been hypothesized to affect behavior and could represent the common neurobehavioral etiology[29].

Behavior:

The prevalence of behavioral problems in children with constipation and fecal incontinence has been reported in several studies. There are many reports that children with constipation and fecal incontinence have more behavioral problems than typically developing children[2]. For example ,Dutch investigators examined the prevalence of behavioral problems in 133 children aged 4 to 18 years and identified as having constipation. Using the Childhood Behavioral Checklist (CBCL) (Achenbach, 1991) investigators found considerable rates of overall (36.8%), internalizing (27.1%) and externalizing (36.1%) behavior problems in children with constipation. Compared with the Dutch norm research sample of the CBCL, overall and internalizing behavior problems were 4 times higher and externalizing problems were 3 times higher among children with constipation[33].Children who fail standard medical management for Retentive Fecal Incontinence (RFI) are reported to have behavior problems than children who succeed[2].

Diet:

Low consumption of fiber, fruit and vegetables, have been suggested to contribute to the development of childhood constipation [34, 35]. Constipation and fecal incontinence has been found to be more prevalent in obese children.[36, 37.]

Toileting and Sensory Processing

Sensory Processing is an important factor in considering a child's attention, memory, behavior, and function [38,6]. Engaging in toileting tasks requires a person to tolerate and respond appropriately to a variety of sensory stimuli[3] .When a child's sensory systems are functioning appropriately, they are able to participate in activities of daily living such as toileting. Hence, if the sensory systems are not integrated properly, this can affect toileting.

Toileting and Sensory Processing Issues Related to Poor Registration of Sensory Input with a Hyperactive or Over-reactive Response[39]

- The child is fearful of the sensations involved when they pee or poop.
- Reports that the act of "peeing" or "pooing" hurts terribly, crying, etc.
- Extreme reaction to the sound of the flush or the air dryer
- Gags, chokes at the smell of the poop

- Visually distracted by details in the bathroom, including lines in the tile, dust on the floor, etc.

Toileting and Sensory Processing Related to Sensory Seeking

- Repetitively flushing the toilet
- Fecal smearing
- Repetitively having accidents in pants, enjoys the sensation
- Playing in the water
- Playing in the sink
- Asks to use the toilet in public constantly

Toileting and Sensory Processing Related to Sensory Defensiveness

- Dislikes the feeling of "peeing" or "pooping" and withholds.
- Fearful of falling in a regular sized toilet
- Dislikes the feeling of wiping or being wiped.
- Prefers the parent to wipe them
- Does not like to wash their hands
- Takes off all their clothes to use toilet
- Avoids flushing the toilet

Toileting and Sensory Processing Issues related to Sensory Avoiding

- Avoids wearing big girl or big boy underwear, prefers a diaper
- Will tell when the diaper needs to be changed, doesn't want a wet diaper
- Difficulty tolerating new bathrooms, public bathrooms, etc.
- Covers ears when flushing, air hand dryer goes on, etc.
- Holds nose for bowel movements
- Avoids using certain toilets with "hard" seats
- Avoids going into the bathroom, "sneaks off" to poop in diaper behind a couch, etc.[39]

Toilet training in India Vs western countries

In traditional villages of India, potty training begins at an early age. The difference between the Western and Indian approach to potty training is that the Western culture focuses more on the use of diapers for children while the Indian approach is diaper free. In India, potty training starts when a child is about 6 months. The children are usually completely potty trained by the time they are 14 months old.

A major disadvantage in Indian toilet training when compared with western culture is that, in western culture they follow a structured pattern of training where as in India we follow an unstructured toilet training depending on respective parents.

According to western culture, toilet training should be started when both the child and parents are ready. Both the American Academy of Pediatrics and the Canadian Paediatric Society recommend starting when a child is 18 months old and shows interest in the process. A majority of United States parents watch for signs of readiness and then let their toddler set the pace. Parents often use special children's books, games and potty chairs to encourage their child's cooperation and progress with potty training. They may also use positive reinforcement techniques such as rewards to get results. Most children are completely potty-trained between the ages of 2 to 3 years old.

Other Countries:

Parents in China usually begin potty training when babies are a few months old. Usually, by 6 months old, Chinese children are able to stay dry throughout the daytime. Even though most parents in Great Britain now leave potty training completion until about 2 years old, a number of grandparents still advocate the completion of potty training by 6 months, as was the norm only a generation ago. Children in Cuba are usually completely potty trained by the age of a year and a half. On the other hand, German parents wait to introduce potty training to young toddlers and then let them progress at their own pace; most are out of diapers by age 3.

Toilet skills in India and other countries:

Toilet paper is used to clean up in the restroom in almost all parts of North America. Most countries in Europe also use toilet paper. In Finland, 'bidet showers' can also be very often seen in use. Most parts of Russia use toilet paper to wipe, and it is flushed down the toilet afterwards. Many parts

of Africa use toilet paper, newspaper or other paper products to wipe down. Where squat toilets are in use, water is usually used to wash. People in Arab countries and in parts of Muslim world, in South Asian countries like India and Pakistan, and in South-East Asian countries like Indonesia and Singapore use water and the left hand to wash. Almost all the toilets have a water source with a 'bidet shower' or a 'health faucet' in the toilet. If not, they have a bucket and/or a mug of water inside the room. Those who can afford it also use toilet paper to dry the area before pulling on the pants.

Sensory integration therapy (SIT):

The theory of sensory integration, together with the treatment approach derived from that theory, grew from the work of Jean Ayres (1969,1972a,1972b).Sensory integration therapy is based on assumptions drawn from neuro-maturation theory and systems theory. Neuromaturation concepts, such as hierarchical organization of cortical and subcortical areas, developmental sequence of learning and skill acquisition, and neural plasticity, are crucial to an understanding of the mechanisms of sensory integration. Systems theory also underlies sensory integration, because the focus is on the child seeking sensory input and using adaptive behavior as an organizer of the input. Based on these assumptions, the SIT approach seeks to provide the child with enhanced opportunities for controlled sensory input, with a particular emphasis on vestibular, proprioceptive, and tactile input, in the context of meaningful activity. In intervention the therapist facilitates an adaptive response, which requires the child to integrate the sensory information. Sensory integration is hypothesized to improve through this process. More recent literature has integrated occupation-based perspectives and emerging theories of motor development in the re conceptualization of sensory integration, but the methods used in SIT remains essentially unchanged.[13]

REVIEW OF LITERATURE

Toilet skill problems and SPD

- *Mary R. Pollock, Alexia E. Metz, Theresa Barabash* .(AJOT 2011) did a study on "**Association between dysfunctional elimination syndrome and sensory processing disorder**" Explored whether SPD is related to dysfunctional elimination syndrome(DES).They used the Vancouver Nonneurogenic Lower Urinary Tract Dysfunction/Dysfunctional Elimination Syndrome Questionnaire and the Short Sensory Profile with participants who sought treatment of DES (n = 19) and healthy control participants (n = 55).This study found that a *majority of children with DES seen in one clinic also presented with SPD, suggesting that a child's sensory processing pattern would be an important aspect that could influence the plan of care.*[3]

- *Isabelle Beaudry Bellefeuille, in one of her another study on* **2014,Examining the Sensory Characteristics of Preschool Children with Retentive Fecal Incontinence** found out the relationship between retentive fecal incontinence and sensory over responsivity and examined the Toileting Habit Profile Questionnaire, a tool designed to screen for toileting difficulties. The study showed that a group of *children (n=16) with retentive fecal incontinence presented with significantly more behaviors related to sensory over-responsivity than a group of typically developing children* (n=27) as measured by the Short Sensory Profile. The study also revealed that the Toileting Habit Profile Questionnaire effectively discriminates between children with retentive fecal incontinence and those without toileting difficulties.[2]

- A study published by *Micah O. Mazurek & Roma A. Vasa* on 2013 in J Abnorm Child Psychol , "**Anxiety, Sensory Over-Responsivity, and Gastrointestinal Problems in Children with Autism Spectrum Disorders"** , the study examined bivariate and multivariate relations among anxiety, sensory over-responsivity, and chronic GI problems in a sample of 2,973 children with ASD enrolled in the Autism Treatment Network (ages 2–17 years, 81.6 % male). *Twenty-four percent of the sample experienced at least one type of chronic GI problem (constipation, abdominal pain, bloating, diarrhea,*

and/or nausea lasting three or more months). Children with each type of *GI problem had significantly higher rates of both anxiety and sensory over-responsivity*. Sensory over-responsivity and anxiety were highly associated, and each provided unique contributions to the prediction of chronic GI problems in logistic regression analyses. The results indicate that *anxiety, sensory over-responsivity and Gastro Intestinal problems are possibly interrelated phenomenon for children with ASD and may be common underlying mechanism.*[40]

- **"Is sensory over-responsivity distinguishable from childhood behavior problems? A phenotypic and genetic analysis"** was a study by *Carol A. Van Hulle, Nicole L. Schmidt, and H. Hill Goldsmith* published in Journal of Child Psychology and Psychiatry (2011), the goal of the study was to delineate the comorbidity between childhood psychopathology and sensory over-responsivity (SOR) in middle childhood using phenotypic and behavior-genetic analyses. Participants (N = 970) were drawn from the Wisconsin Twin Project, a population-based sample of twins and their families. Mothers completed a sensory responsivity checklist when their offspring were on average 7 years old, followed by a diagnostic interview (Diagnostic Interview Schedule for Children; DISC) within6–12 months. They examined the incidence of DISC diagnoses – attention deficit hyperactivity disorder,conduct disorder, oppositional defiant disorder, agoraphobia, general anxiety, obsessive-compulsive disorder, panic disorder, separation anxiety, social phobia, specific phobia, depression, **enuresis**, trichtollomaniatics, selective mutism, and pica – among children with SOR, and vice versa. Children with autism or pervasive developmental disorders were excluded from the present study. In addition, they examined parent-reported physical health diagnoses among nondiagnosed children and three groups of children with SOR and/or DISC diagnoses. *Results suggest that SOR occurs independently of recognized childhood psychiatric diagnoses but is also a relatively frequent comorbid condition with recognized diagnoses*[41].

Effectiveness sensory integration therapy on toilet skills:

- *Isabelle Beaudry Bellefeuille, Roseann C. Schaaf, Eduardo Ramos Polo* did a study on **Occupational Therapy Based on Ayres Sensory Integration in the Treatment of**

Retentive Fecal Incontinence in a 3-Year-Old Boy published on September 2013 (AJOT) Sensory integration theory was used to address the over responsivity affecting the child's ability to acquire age-appropriate toileting habits. 7 mo of treatment and 3 mo of follow-up in occupational therapy were implemented. Results shows improvements *in acquiring age-appropriate toileting habits were documented and measured using daily defecation logs following SI therapy.*[42]

- A study on **Combined treatment of voluntary stool retention with medication and occupational therapy** published by *Beaudry Bellefeuille, I & Ramos Polo, E.* (2011), used a therapeutic approach for the treatment of voluntary stool retention. The approach *combines occupational therapy based on sensory integration (Ayres Sensory Integration-ASI®) therapy* with a pharmacological treatment prescribed by a primary care paediatrician or paediatric gastroenterologist. *Children aged from 24 months to 42 months were included in this study and results shows 84% had significant improvement.*[8]

Behavior problems and toilet skill issues:

- A study done on **Clinical Features of Children with Encopresis and Their Comorbid Psychiatric Disorders by** *Selma Tural & Zeynep GOKER (*2009*)*. The study population consisted of children who were older than 4 years with soiling. Clinical charts of patients with fecal soiling were examined retrospectively. 107 children [83 boys, 24 girls] were found to fulfill the diagnostic criteria for encopresis according to Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. The study showed *Encopresis as a disruptive impairment that may affect a child's social, emotional, and educational development. Encopresis is frequently accompanied by a psychiatric disorder. The study also shows significantly high rates of behavioral and emotional problems in children who soil.*[43]

- A study done on **Prevalence and Associated Clinical Characteristics of Behavior Problems in Constipated Children** by *Marieke van Dijk, Marc A. Benninga, Martha A. Grootenhuis, Bob F. Last* (2010)examined133 Children who had functional constipation, were aged 4 to 18 years. Prevalence of behavior problems was assessed by the Child Behavior Checklist. Results *shows prevalence rate of overall, internalizing, and*

externalizing behavior problems was considerable: respectively 36.8%, 36.1%, and 27.1% compared with 9% in the Dutch norm population. A long duration of treatment was found to have the strongest association with overall and externalizing behavior problems in children with constipation. Children with constipation and nighttime urinary incontinence have an increased risk for having overall behavior problems. Fecal incontinence and the production of large stools seemed to be exclusively related to externalizing behavior problems. The study concluded that *Behavior problems are common in children who have constipation*.[44]

- **What do pediatrics residents know about the psychological factors in constipation?** Was a study done by *Claudia dos Reis Motta, Sandro Iêgo, Juliana de Oliveira, Hélio de Castro, Luciana,Rodrigues Silva* on 2013. A cross sectional, descriptive study was developed with 42 medical residents from Salvador, Brazil, using a questionnaire on constipation diagnosis, therapy, complications and related factors. The results show that *95.2% mentioned diet as a triggering factor of constipation, 26.6% organic diseases, 38.0% parents' emotional factors, and 23.8% child's emotional factors. Associated aspects included hostile family environment/sexual abuse (88.1%), parental crisis (66.7%), fear/anxiety (78.6%), maternal control (61.9%). Reasons for referring the patient to psychotherapy included psycho affective aspects (76.1%). Regarding treatment, 97.6% performed dietary changes.* All acknowledged the need for more information on Functional constipation (FC).[45]

- Ellen R. Wald, yCarlo Di Lorenzo, zLynne Cipriani, zD. Kathleen Colborn,yRosa Burgers, and §Arnold Wald published a study in Journal of Pediatric Gastroenterology and Nutrition(2009) on "**Bowel Habits and Toilet Training in a Diverse Population of Children"** the study aimed to gather data concerning bowel habits and toilet training of developmentally normal children ages 5 to 8 years. A questionnaire containing information on age, race, and sex was completed anonymously by a parent in 9 pediatric practices. Recall information was elicited about onset and completion of toilet training, frequency and quality of stooling, size of bowel movements, and behavioral components of defecation. Results shows *toilet training started at a mean of 27.2 months and was*

completed at a mean of 32.5 months. Of the children, 95% defecated either daily or every other day. Straining at defecation and infrequent stooling were reported significantly more often for girls, whereas staining of underclothes and passage of large bowel movements were reported more often in boys. Approximately 10% of children fulfilled criteria for functional constipation.[46]

Toilet training using behaviour modification:

- *Klassen TP, Kiddoo D, Lang ME, Friesen C, Russell K, Spooner C, Vandermeer B* (2006) did a meta analysis on "**The effectiveness of different methods of toilet training for bowel and bladder control" .**Data sources were collected from MEDLINE, Ovid MEDLINE In-Process & Other Non-Indexed Citations, Ovid OLDMEDLINE, Cochrane Central Register of Controlled Trials, EMBASE, CINAHL, PsycINFO, ERIC, EBM Reviews, HealthSTAR, AMED, Web of Science, Biological Abstracts, Sociological Abstracts, OCLC Proceedings First, OCLC Papers First, Dissertation Abstracts, Index to Theses, National Research Register's Projects Database, and trials registers. Twenty-six observational studies and eight controlled trials were included. Approximately half of the studies examined healthy children while the remaining studies assessed toilet training of mentally or physically handicapped children. *For healthy children, the Azrin and Foxx method performed better than the Spock method, while child-oriented combined with negative term avoidance proved better than without*. *For mentally handicapped children, individual training was superior to group methods; relaxation techniques proved more efficacious than standard methods; operant conditioning was better than conventional treatment, and the Azrin and Foxx and a behavior modification method fared better than no training*. The child-oriented approach was not assessed among mentally handicapped children.[47]

- **Treating Non-Retentive Encopresis with Rewarded Scheduled Toilet Visits** was a study done by *Richard E Boles, Michael C Roberts, and Eric M Vernberg*, on 2008 (Behavioral Analysis in practice) . The study evaluated the effects of rewarded scheduled toilet sits on non-retentive encopretic behavior of an elementary-school student receiving services for serious emotional disturbance. A multidisciplinary team implemented the 8-

week intervention using a multiple baseline across settings design. The results showed *an increase in sitting on the toilet and a decline in encopretic episodes in both school and home settings. These findings support the use of a behavioral intervention for children with significant behavioral disorders within a classroom setting.*[48]

Diet and bowel function:

- **Effects of cereal fiber on bowel function: A systematic review of intervention trials** was a study done by Jan de *Vries, Paige E Miller, Kristin Verbeke* published in World Journal of Gastroenterology 2015 Augus the aim of the study was too comprehensively review and quantitatively summarize results from intervention studies that examined the effects of intact cereal dietary fiber on parameters of bowel function. A systematic literature search was conducted using PubMed and EMBASE. Supplementary literature searches included screening reference lists from relevant studies and reviews. Eligible outcomes were stool wet and dry weight, percentage water in stools, stool frequency and consistency, and total transit time. The study concluded that, *Wheat dietary fiber, and predominately wheat bran dietary fiber, improves measures of bowel function.*[49]

CONCEPTUAL FRAMEWORK

Continence requires the complex integration of signals among the smooth muscle of the colon and rectum, the puborectalis muscle, and the anal sphincters. As colonic contents are presented to the rectum, the rectum distends. The sensation of rectal distension is most likely transmitted along the S2, S3, and S4 parasympathetic nerves. This results in a parasympathetically mediated relaxation of the IAS (rectoanal inhibitory reflex) and a contraction of the EAS (rectoanal contractile reflex).[57]

Rectal contents are allowed to come into contact with the very sensitive epithelial lining of the upper anal canal. The epithelial lining of the upper anal canal has a rich supply of sensory nerve endings, especially in the region of the anal valves. The contents are then sampled as to their nature (ie, gas, liquid, or solid). This sampling is described as an equalization of the rectal and upper anal canal pressures. Miller et al found that sampling occurred spontaneously in 16 of 18 control patients but in only 6 of 18 incontinent patients. Miller's study also demonstrated that patients with impaired continence had decreased thermal and electrical sensitivity to stimuli.[51]The decreased anorectal sensation and abnormal sampling likely contribute in the pathogenesis of anal incontinence as sampling facilitates the fine tuning of the continence barrier.

Autonomic nervous system function in bowel and bladder control:

In the study by Pollock reported that, bladder and bowel control and activation are dependent on the balance of and interaction between the branches of the autonomic nervous system. The sympathetic nervous system is primarily responsible for maintaining optimal blood supply to the organs by either decreasing sympathetic activity through vasodilatation or increasing sympathetic activity through vasoconstriction of the blood vessels. Sympathetic stimulation also inhibits contraction of the bladder and bowel walls and contracts internal sphincters. The primary responsibility of the parasympathetic nervous system is energy conservation. It facilitates digestion and regulates bowel and bladder voiding. For the bladder and bowels the effects of the sympathetic and parasympathetic system are synergistic. A decrease in the sympathetic activity with an increase in parasympathetic activity facilitates voiding of the bladder and bowel.

Autonomic nervous system implicated in SPD

Researches have demonstrated that individuals with SPD have abnormal sympathetic and parasympathetic reactions in response to sensory stimuli. Pollack has reported that Schaaf, Miller, Seawell, and O'Keefe's (2003) study examines parasympathetic disturbance in relation to SMD. Measures were taken during the Sensory Challenge Protocol, which is a test that measures responses to repeated sensory stimulation in 5 areas with 10 continuous trials. Areas include olfactory, auditory, visual, tactile, and vestibular. The participants with disturbances in sensory modulation had statistically significant lower cardiac vagal tone, which serves as evidence of less effective parasympathetic functioning.

In addition Pollack in her study hypothesized that the function of bowel and bladder voiding is dependent on a synergistic balance between the sympathetic and parasympathetic nervous system and that SPD may result from an imbalance in the autonomic nervous system, is it possible that DES and SPD co-existand are related to one another. And found out that 53%of children with dysfunction elimination syndrome had SPD.[3]

Beaudry in her case study proved that sensory integration therapy (SIT) was useful framework for addressing a SPD child's toileting habits. Therefore it is assumed that sensory integration therapy can have an effect on reducing sensory processing difficulties and toilet skill problems for SPD children.

Sensory integration frames of reference

The theoretical base of sensory integration frames of reference is unique in that it deals specifically with the contributions of the subcortical areas of the brain to human behavior. The five systems auditory, visual ,vestibular, proprioceptive and tactile provide the basis for the development of functional support capabilities that lead to the end product abilities. To produce the desired adaptive response in end product ability, the person must have sensory system modulation within normal levels and reasonable functional support capabilities. Optimal functioning means all systems and capabilities work integratively.

Sensory integration theory proposes that by providing an optimal sensory environment and inviting active participation of the individual, both structure and functional growth occurs within central nervous system. Vestibular, tactile, and proprioceptive systems are primitive and primary; they

dominate the child's interactions with the world early in life. These 3 systems are highlighted to be the precursors to development of auditory and visual system.

Occupational therapy intervention:

This understanding enables occupational therapy intervention to focus on sensory integration based therapy program to facilitate toilet skills. Such treatment will provide an optimal environment which contributes active participation of child in toileting skills through sensory integration.

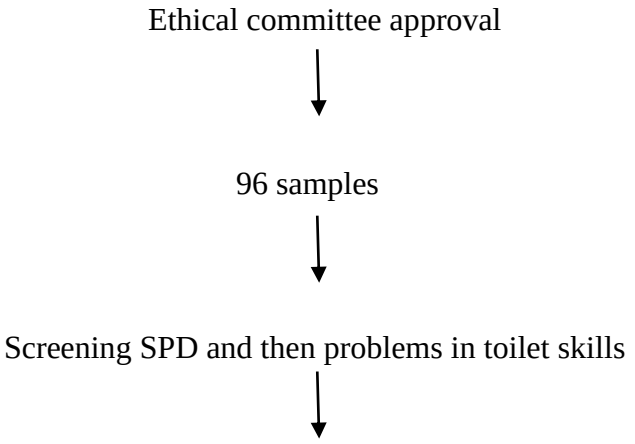
METHODOLOGY

Research Design

. A cross-sectional survey and quasi experimental pre-post test design was adopted for the study. The study consisted of two phases, in the phase I a survey was done to find out the prevalence of toilet skill problems among children with sensory processing disorder. The phase II of the study was to find out the effectiveness of sensory integration therapy on toilet skill development using a control group design.

Phase I-Survey Method

Schematic Representation of the Research Design (Phase I):



Setting of the study:

The study was conducted in and around the Coimbatore and also outside the Coimbatore. This includes,

- Kovai Medical Centre and Hospital Department of occupational therapy Coimbatore,Gandhipuram and Erode.
- Adithi Centre for Developmental Delays, SaiBaba Colony, Coimbatore.
- Shriano Therapy Centre, Gandhipuram, Coimbatore.
- Jewel Autism Centre, Kottayam, Kerala.
- Sri Prasanthi Academy, Saravanampatty, Coimbatore.

Sampling:

Convenience sampling method was used to select the sample based on criteria.

Sample population:

Children with potential of having SPD is included for the study purpose

Sample size:

Confidence level (CL) = 95%

Expected proportion (P) = 0.53 (calculated according to the results of the mother study)[3]

Total width of confidence interval (W) = 0.2

Normal approximation to the binomial calculation:

$\alpha=(1-CL)/2=0.025$

Standard normal deviate for $\alpha = Z\alpha=1.960$

Sample size $=N=4Z\alpha^2P(1-P)/(W^2)=96$

SELECTION CRITERIA

Inclusion criteria

- Children with conditions like autism, Attention Deficit Hyperactivity Disorder, Learning Disability, Fragile X Syndrome, children with emotional problems etc. with potential of having Sensory Processing Disorder (SPD).
- Children between 3-10 years of age
- Both boys and girls

Exclusion Criterion

- Children with physical dysfunctions were excluded.
- Children with visual and hearing impairments.

TOOLS, EQUIPMENTS AND OUTCOME MEASURES

Sensory profile

- The Sensory Profile is a 125-question caregiver-completed profile that reports the frequency of the person's response to various sensory experiences (Dunn, 1999).
- Caregivers are asked to check the box that best describes the frequency with which the subject engages in the listed behaviors.
- Choices are: never (five points); seldom (four points); occasionally (three points); frequently (two points); and always (one point).
- On the Sensory Profile, lower scores indicate greater SPD symptoms.
- The Sensory Profile includes high and low threshold items. High threshold items measure an individual's lack of response or need for more intense stimuli.
- Low threshold items measure a person's notice of or annoyance with sensory stimuli.

Psychometric property: The Cronbach's Alpha for the internal consistency for the various sections ranged from.47 to .91 (Dunn, 1999). Construct validity was rated as high when compared to the functional tasks measured by the School Function Assessment (Coster, Deeney,Haltiwanger, & Haley, 1998). Internal validity correlations ranged from .25 to .76,

suggesting that the sections of the Sensory Profile use relatively unique constructs and support the factor structure.

2) Canadian occupational performance measure (COPM)

COPM is a criterion-based measure of occupational performance in which clients rate the level of importance of, performance of, and satisfaction with goals in self-care, productivity, and leisure on a 10-point scale. A change of 2 or more points in the mean score on the COPM has been reported to indicate clinically significant change. The COPM was developed to detect change in self perception of occupational performance and satisfaction over time in persons with variety of disabilities. In a systematic review, Carswell states that the COPM is a valid, reliable and clinically useful tool to measure change in occupational performance and client satisfaction with the outcome of therapy (Careswell 2004).

For the present study, under self-care component caregivers were asked to identify issues in toilet skills and rate importance, performance and satisfaction scores ranging from 1 to 10, hence identified problems in toileting skills of their children.

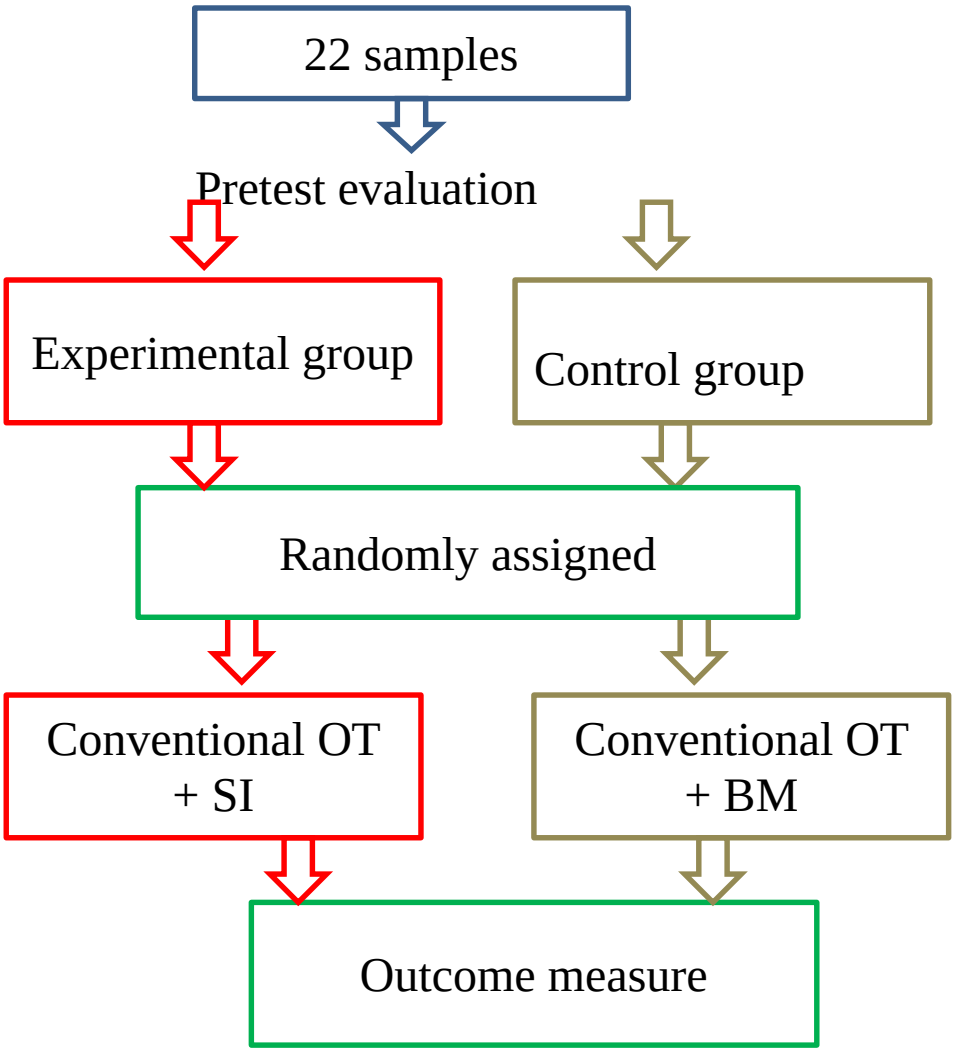
PROCEDURE

- Attainment of approval from the ethical committee.
- The parents of children with conditions like autism, ADHD,LD,FXS,etc. with potential of having Sensory Processing Disorder(SPD) and having complaints of toileting problems were invited for the study.
- Permission from the institutions and written Consent from parents and were received.
- Parents of included children were asked to fill the sensory profile and Canadian occupational performance measure (COPM) was used to analyze problems in toileting skills.
- Associated sensory problems from the sensory profile to the toilet skill problems identified from COPM. Thus, to find out whether children with SPD is having high chances for toilet skill problems.

- The collected data were then subjected to statistical analysis.

PHASE - Effectiveness of SIT on toilet skill development in children with SPD.

Schematic Representation of the Research Design (Phase II):



Setting of the study:

- Kovai Medical Centre and Hospital Department of occupational therapy Coimbatore.
- Adithi Centre for Developmental Delays, SaiBaba Colony, Coimbatore.
- Shriano Therapy Centre, Gandhipuram, Coimbatore.
- Sri prashanthi academy, saravanapetti, Coimbatore

Sample population: Children with SPD and problems in toilet skills (problem in defecation regularity in toilet) was included for the study purpose.

Sample size: 22

Sampling: Convenience sampling, first available primary data was assigned for the study.

Selection Criteria:

Inclusion criteria

- Children between 3-10 years of age
- children with poor toileting skills (bowel)
- Children who had been screened out using sensory profile(with a score of probable difference or definite difference ie, deviating more than or less than from typical performance)

Exclusion criteria:

- Children who are under other laxative therapy , enemas, and suppositories, biofeedback and medication for constipation

Variables:

- **Independent variables** – sensory integration therapy and behavior therapy.
- **Dependent variables** –sensory processing over responsiveness to tactile, olfactory and auditory stimulus; under responsive to tactile stimuli, toileting skills

- **Extraneous variables** – children regularly attending OT, children receiving conventional medical management, positive reinforcements used naturally by adults.

Tools, Equipments and Outcome Measures

1) **Toileting scheduling chart- modified baseline chart**

This scheduling chart was specifically developed for this study to identify the diet followed by the child (the amount of water intake and fiber intake), the regularity of defecation, spontaneity of defecation, the place and amount of defecation and also the information regarding readiness cue. This chart is used to record toilet incident for 1 week before and after intervention.(Appendix IV)

2) Sensory profile

3) COPM (Canadian Occupational performance Measure)

Procedure

- A written consent had assured from the head of the institution to conduct study.
- The purpose of the study was explained and informed, also a written consent obtained from the parents prior to the study.
- Using convenient sampling,22 children were selected from phase I and were divided into 2 groups randomly: experimental and control,11 in each
- Baseline measures were collected using sensory profile, COPM and toilet scheduling chart. The modified baseline schedule marked by the parents for 1 week was collected prior to the intervention.
- The bowel tolerance of the child was identified using the modified baseline schedules.
- Both experimental group and control group were undergoing regular occupational therapy session and diet modification classes for the parents.
- Participants in the study were advised to follow fiber rich food.

For Experimental Group,

1. SI treatment was based on the particular sensory processing disorders faced by each child according to sensory profile and the goal was to integrate those disorders which affect toilet skills.

   The therapy room was equipped with mats, swings, small trampoline, therapeutic balls and a variety of toys that offer sensory stimulus (weight, vibration, etc.).
2. After completion of the therapy session the caregiver was briefed about the session.
3. Parents were given a list of activities and toilet adaptation strategies to be done at home to meet the child's sensory needs. For example children with auditory sensitivity, parents were advised to make the child wear headsets with calming music's or ear plugs while using toilet. For children with tactile sensitivity, dry toilet seats, use of potty and use of chapels inside the toilet were advised.
4. Parent's were taught to monitor child's alertness level and strategies for self-regulation.

Intervention was continued for 4 months, twice in a week for 45minutes by the researcher and the same therapy is continued by the parents in the rest of the days. After 4 months outcome measures was taken using Sensory Profile, COPM and the toilet chart.

For the control group,

1. Behavior modification therapy were administrated and also taught to parents to be followed at home to develop appropriate toilet skills and to reduce bowel accidents for their children for 4 months.
2. The child's pants were checked every 1 hour by parents and reinforced for dry and clean pants. The child was also taken to the toilet every day soon after getting up from the bed and also the expected time of defecation according to the diet chart for about 10 minutes, reinforcing him for any attempt to defecate and any soiling result trainer to say sternly "wet pants, bad boy" and pants were changed. If the child was one who finds this as very reinforcing, then instead his pants were changed without the trainer saying anything (ignoring). Modeling(how to sit and defecate) and shaping (reinforcement for any attempt or successive approximation) were the other techniques taught to the parents.
3. Follow up for the behavior modification was conducting by enquiring twice in a week to the parents.

After 4 months, post schedules were distributed (sensory profile, COPM, toilet schedule chart) to the parents of both control and experimental group and data were analyzed.




DATA ANALYSIS AND RESULTS

To reach the aim of finding association between problems in toilet skills and sensory processing disorder, the study was conducted with the objective to find the prevalence of problems in toilet skills in children with sensory processing disorder (SPD) among 96 children between the age group of 3-10 years. To measure the effectiveness of sensory integration therapy for toilet skill problems, 22 children were taken from the survey, where all of them having both SPD and toilet skill problems. The participants were divided into 2 groups 11 in experimental and 11 in the control group. Sensory integration therapy was used for children in the experimental group and behaviour modification techniques were used for the control group. The outcomes were measured comparing their sensory behaviors' using sensory profile and performance using the diet chat and COPM.

The scores of the experimental and the control group were subjected to statistical analysis by using IBM SPSS version 20. The descriptive analyses were performed to characterize the groups and inferential analyses to compare the performance of the groups (Mann Whitney U, Wilcoxon, Paired sample t- test) were used.

Descriptive statistics was used to find out the mean, SD and percentage of prevalence.

Wilcoxon signed rank test was used for the within group comparison

Mann-whitney U test was used for the comparison between groups

Effect size was calculated by using the formula,

Effect size:

$$d = M_1 - M_2 / \text{Spooled}$$

$$\text{Spooled} = \sqrt{[(S_1^2 + S_2^2) / 2]} \text{ where}$$

d is the descriptive measure(difference between the means) Cohen's

M_1 and M_2 are means of experimental and control group

Spooled is the pooled standard deviation (the square root of the average of the squared standard deviations S_1 and S_2)

Effect size were interpreted according to criteria set by Cohen's d . An effect size of 0.2 to 0.49 was interpreted as small, 0.50 to 0.79 as moderate and 0.80 or greater as large.

Analysis using manual statistical method of Odd's ratio was used for analyzing defecation of passing inside and outside toilet, hence to find out effectiveness of sensory integration therapy on toilet skills. Odd's ratio method was used to compare pre test and post test scores of the control and experimental group.

Odd's ratio:

The odd's ratio is the ratio of odds of an event occurring in one group to the odds of it occurring in another group

$$\frac{p_1/(1-p_1)}{p_2/(1-p_2)} = \frac{p_1/q_1}{p_2/q_2} = \frac{p_1 q_2}{p_2 q_2},$$

Where $q_x = 1-p_x$. An odd ratio 1 indicates that the condition or event under the study is equally likely to occur in the both groups. An odd ratio less than 1 indicates that the condition or event is more likely to occur in the first group. An odd ratio less than one indicate that the condition or event is less likely to occur in the first group. The odds ratio must be greater than or equal to zero if it is defined. It is undefined if p_2q_1 equals zero.

Table 1: Demographic Details of the Participants in the Survey study

N	Gender		Age Mean	Stand deviation
	Boys	Girls		
96	76	20	5.10	3.48

As shown in table 1 this study consisted of 96 children with sensory processing children of whom 76 were boys and 20 were girls. The children age ranged from 3-10 year with a mean age of 5.10+_sd value 3.48

Table 2: Percentage of Children With and Without Toilet Skill Problems Among SPDs

(n= 96)

Children with toilet skill problem%(n)	Children without toilet skill problem%(n)
68.75%(66)	31.25%(30)

Graph 2. Graphical Representation of Percentage of Children With and Without Toilet Skill Problems

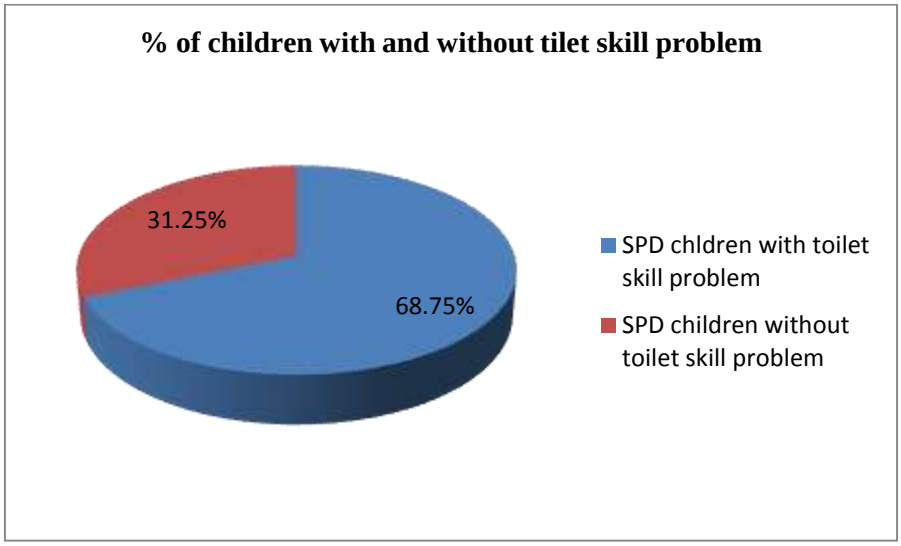


Table 2 ,graph 2 shows the percentage of SPD children with toilet skill problems were 68.75% and without toilet skill problems were 31.25%.

Table 3: Percentage of Section Domain among SPD Children having Toilet Skill Problem

Sections	Total deviation			Typical performance in %
		Among Deviators		
	Over all %	Less than others in %	More than others in %	
Auditory processing	60.6	6.1	54.5	39.4
Visual processing	47	28.8	18.2	53
Vestibular processing	80.3	0	78.3	21.2
Touch processing	48.5	1.5	47	51.5
Multisensory processing	68.2	7.6	60.6	31.8
Oral sensory processing	58.5	7	51.5	37.9
Sensory processing related to endurance or tone	27.3	0	27.3	72.7
Modulation related to body position and movement	53	3	50	47
Modulation of movement affecting activity level	46.7	4.5	42.4	53
Modulation of sensory input affecting emotional responses	53	0	53	47
Modulation of visual input affecting emotional response and activity level	62.12	10.6	51.5	37.9
Emotional/social responses	50	10.6	39.4	50
Behavioral outcomes of sensory processing	60.6	6.1	54.5	39.4
Items indicating thresholds for response	48.5	0	48.5	51.5

It indicates auditory processing, vestibular processing, multisensory processing, modulation of visual input affecting emotional responses and activity level and behavioral outcomes of sensory processing have a greater variance to total deviators, among them all of the variables shows greater with more than others.

Table 4: Percentage of Factor Domain Among SPD Children Having Toilet Skill Problem

Factors	Total deviation			Typical performance in %
	Over all %	Less than others in %	More than others in %	
Sensory seeking	48.4	4.5	43.9	51.5
Low endurance /tone	33.3	3	30.3	66.7
Oral sensory sensitivity	53	10.6	42.4	47
Inattention/distractibility	55.5	3	52.5	43.9
Poor registration	45.5	0	45.5	54.50
Sensory sensitivity	44.94	1	43.9	54.5
Sedentary	59.1	25.8	33.3	40.9
Fine/perceptual	51.5	0	51.5	48.5

The above table shows a greater deviation of total deviators for inattention/distractibility and sedentary when compared with typical performance and among the total deviators most of them comes in more than others.

Table 5: Percentage of Quadrant Domain Among SPD Children Having Toilet Skill problem

Quadrants	Total deviation			Typical performance in %
	Over all %	Less than others in %	More than others in %	
Registration	56.1	15.2	40.9	43.9
Seeking	62.5	8	54.5	33.3
Sensitivity	77.2	4.5	72.7	22.7
Avoiding	62.1	4.5	57.6	37.9

All the quadrant variables shows total deviation more than the typical performance, among them most of the children comes under more than others category.

Table 6: Participant Characteristics (Children) of Experimental and Control group

Group	N	Gender (N)		Age
		boys	girls	Mean& SD
Experimental	10	7	3	3.72 ± 0.33
Control	11	9	2	4.22 ± 1.22

The above table shows that there were 7 males and 3 girls in the experimental group and 9 boys and 2 girls in the control group. The mean age of experimental group was 3.72 ± .33 and that of control group was 4.22 ±1.22.

Table 7.1 Descriptive Statistic of Canadian Occupational Performance Measure: Performance and Satisfaction component

Outcome measure	Group	Test	Mean	Std dev	min	max
performance	Exp	Pre	26.31	10.40	12.00	47.90
		Post	58.88	13.78	32.00	78.00
	Con	Pre	27.70	14.65	9.00	56.00
		Post	39.96	16.57	18.20	74.00
Satisfaction	Exp	Pre	21.60	11.77	11.00	45.90
		Post	57.28	14.63	30.00	78.00
	Con	Pre	25.18	12.20	9.00	46.00
		Post	37.43	16.68	18.20	74.00

The above table shows the descriptive statistic of Canadian Occupational Performance Measure: performance and satisfaction component

Table 7.2 Comparison between Control and Experimental Group Scores Pre and Post Test on Components of COPM (Toilet Skills Alone)

Test	Outcome measure	Group	N	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pretest	performance	experimental	11	11.64	128.00	59.00	0.92
		control	11	11.36	125.00		
	satisfaction	experimental	11	10.36	113.50	47.50	0.39
		control	11	12.68	139.50		
Posttest	performance	experimental	10	14.30	143.00	22.00	**0.02**
		control	11	8.00	88.00		
	satisfaction	experimental	10	14.65	146.00	18.50	**0.01**
		control	11	7.68	84.50		

Graph 7.1: Graphical representation of Comparison between control and experimental group scores pre and post test on components of COPM (toilet skills alone)

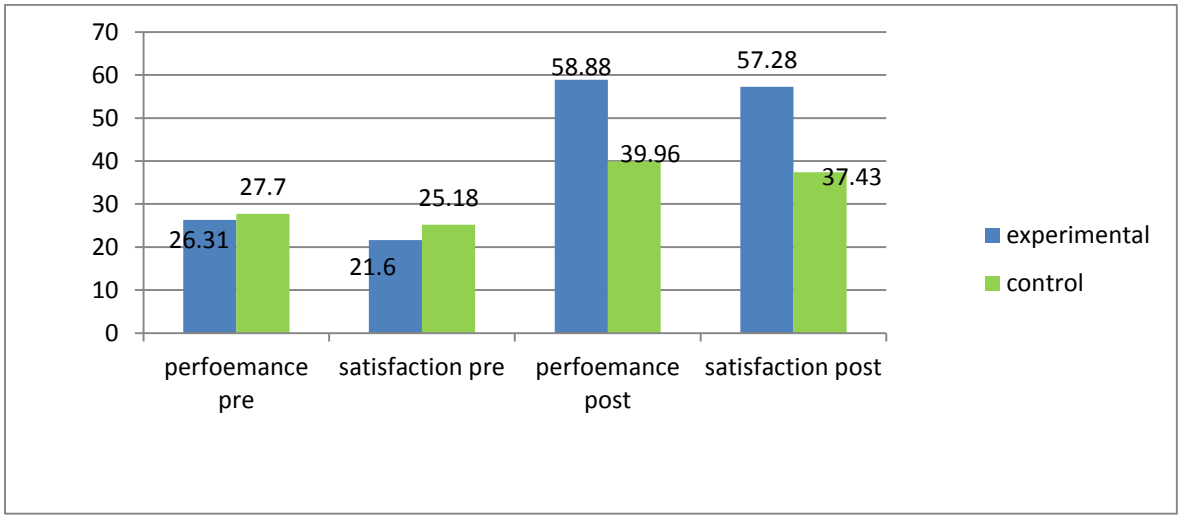


Table 7.2, Graph 7.1 shows that there is no significant differences in the pretest of the performance and satisfaction components; P is 0.92(>0.05) and 0.39(>0.05) respectively .This indicates that there is homogeneity of the group and thus post test score can be compared. There is significant differences in the post test of performance and satisfaction; P is 0.02(> 0.05) and 0.01(> 0.05).

There were at least 5 goals chosen by the parents ;example indication before toileting, moving towards toilet, sitting on the toilet seat, removing dress and acceptance of cleaning with normal water.

Table 7.3: Comparison of Components of COPM within the groups

Domains	Group	Test	Positive Rank	Negative Rank	Ties	Z score	Sig(2tailed)
Performance	exp	Posttest- pretest	10	0	0	-2.803	**0.005**
	con	Posttest- pretest	10	1	0	-2.852	**0.004**
Satisfaction	exp	Posttest- pretest	10	0	0	-2.803	**0.005**
	con	Posttest- pretest	10	1	0	-2.851	**0.004**

The results shows there is a significant difference in both experimental group and control group for performance and satisfaction components, P is 0.005(<0.05) for experimental group and P is 0.004(<0.05) for control group in for performance and satisfaction components respectively.

The rank values of experimental group shows 10 positive ranks and that of control group shows 10 positive and 1 negative ranks.

Table 7.4 Comparing the mean scores of pretest and posttest of both experimental and control group to find out the mean difference and effect size of COPM

Variable	Mean		SD		Mean difference	Effect Size	t	df	Sig (2-tailed)
	Post	Pre	Post	Pre					
Performance exp	58.88	26.31	13.78	10.40	-32.57	0.7	-7.775	9	0.00
Satisfaction exp	57.28	21.60	16.57	14.65	-35.68	0.7	-6.961	9	0.00
Performance con	39.96	27.70	16.57	14.65	-12.26	0.36	-2.72	10	0.021
Satisfaction con	25.18	37.43	12.20	16.68	12.25	0.38	-2.82	10	0.018

Graph 7.2 Graphical Representation of Effect Size of COPM for Experimental Group and Control Group

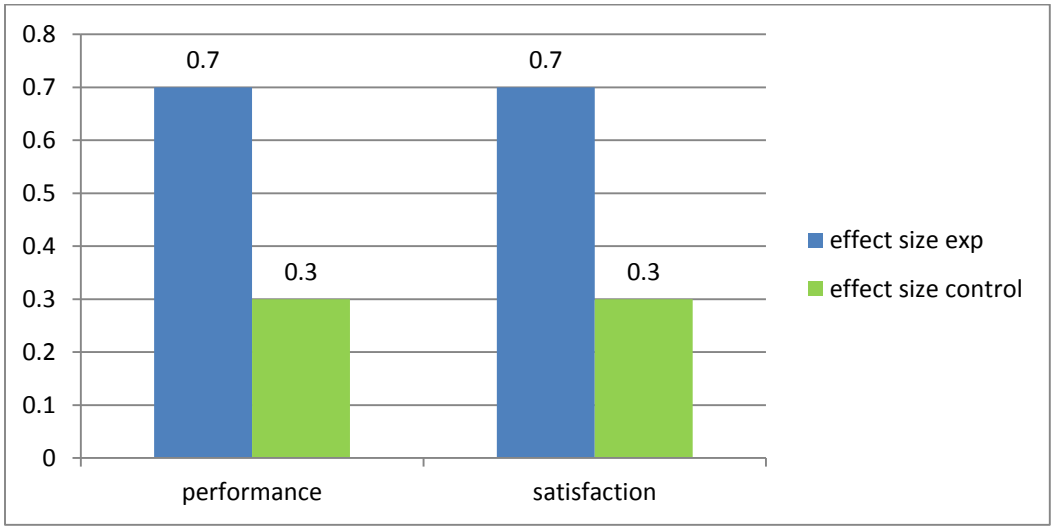


Table 7.4, Graph 7.2 The above results show that there is a medium effect size for COPM components of experimental group. It also show that there is a small effect size for COPM components of control group.

Table 8.1 Descriptive Statistic of sensory profile: section component of pretest

Section	Group	Mean	Std Dev	Min	Max
Auditory processing	Exp	30.70	5.46	20.00	37.00
	Con	33.63	8.88	21.00	45.00
Visual processing	Exp	37.81	5.72	28.00	45.00
	Con	38.09	8.28	19.00	45.00
Vestibular processing	Exp	42.81	7.38	24.00	53.00
	Con	43.63	5.86	35.00	53.00
Touch processing	Exp	72.63	11.03	56.00	90.00
	Con	62.90	20.33	18.00	88.00
Multisensory processing	Exp	25.45	7.10	15.00	34.00
	Con	26.18	4.72	18.00	34.00
Oral sensory sensitivity	Exp	47.00	8.31	35.00	60.00
	Con	45.09	7.27	35.00	50.00
Sensory processing related to tone /endurance	Exp	39.81	6.17	24.00	45.00
	Con	38.90	8.74	20.00	45.00
Modulation related to body position and movement	Exp	41.63	4.86	32.00	47.00
	Con	41.27	4.69	35.00	50.00
Modulation of movement affecting activity level	Exp	23.09	7.07	11.00	34.00
	Con	25.90	2.91	22.00	30.00
Modulation of sensory input affecting emotional responses	Exp	14.09	2.11	11.00	19.00
	Con	13.72	2.37	9.00	17.00
Modulation of visual input affecting emotional responses and activity level	Exp	14.18	4.46	7.00	20.00
	Con	15.00	3.25	10.00	19.00
Emotional /social responses	Exp	63.18	12.92	45.00	78.00
	Con	57.00	11.68	42.00	75.00
Behavioral outcomes of sensory processing	Exp	16.45	6.66	8.00	30.00
	Con	17.45	5.26	5.00	24.00
Items indicating thresholds	Exp	11.72	2.28	8.00	15.00
	Con	10.09	2.94	6.00	15.00

Table 8.2 Comparison between Pre Test Scores of Experimental and Control Group in SP

Section	Group	N	Mean rank	Sum of rank	U score	Sig (2tailed)
Auditory processing	Exp	11	9.27	102.00	36.00	0.106
	Con	11	13.73	151.00		
Visual processing	Exp	11	10.50	115.50	49.50	0.468
	Con	11	12.50	137.50		
Vestibular processing	Exp	11	11.36	125.00	59.00	0.921
	Con	11	11.64	128.00		
Touch processing	Exp	11	13.32	146.50	40.50	0.188
	Con	11	9.68	106.50		
Multisensory processing	Exp	11	10.86	119.50	53.50	0.645
	Con	11	12.14	133.50		
Oral sensory sensitivity	Exp	11	12.18	134.00	53.00	0.621
	Con	11	10.82	119.00		
Sensory processing related to tone /endurance	Exp	11	10.95	120.50	54.50	0.686
	Con	11	12.05	132.50		
Modulation related to body position and movement	Exp	11	12.23	134.50	52.50	0.598
	Con	11	10.77	118.50		
Modulation of movement affecting activity level	Exp	11	10.14	111.50	45.50	0.323
	Con	11	12.86	141.50		
Modulation of sensory input affecting emotional responses	Exp	11	11.41	125.50	59.50	0.947
	Con	11	11.59	127.50		
Modulation of visual input affecting emotional responses and activity level	Exp	11	11.00	121.00	55.00	0.717
	Con	11	12.00	132.00		
Emotional /social responses	Exp	11	13.18	145.00	42.00	0.224
	Con	11	9.82	108.00		
Behavioral outcomes of sensory processing	Exp	11	10.09	11 1.00	45.00	0.308
	Con	11	12.91	142.00		
Items indicating thresholds	Exp	11	13.50	149.00	38.00	0.135
	Con	11	9.45	104.00		

The results shows that there are no significant differences in the pre and post tests of components of sections in sensory profile, P is>0.05 .This indicates that there is homogeneity of the group and thus post test score can be compared.

Table 8.3 Descriptive Statistic of sensory profile: section component of post test

Section	Group	Mean	Std Dev	Min	Max
Auditory processing	Exp	34.70	2.94	30.00	39.00
	Con	33.36	6.24	20.0	40.00
Visual processing	Exp	40.10	5.38	28.00	45.00
	Con	37.81	7.96	22.00	45.00
Vestibular processing	Exp	48.30	4.37	39.00	54.00
	Con	44.63	5.29	36.00	53.00
Touch processing	Exp	80.00	4.18	74.00	86.00
	Con	70.00	10.36	55.00	85.00
Multisensory processing	Exp	29.20	4.93	21.00	35.00
	Con	26.45	4.61	18.00	33.00
Oral sensory sensitivity	Exp	51.90	4.95	44.00	59.00
	Con	44.90	7.66	35.00	57.00
Sensory processing related to tone /endurance	Exp	43.50	3.13	39.00	50.00
	Con	38.27	8.24	20.00	45.00
Modulation related to body position and movement	Exp	45.50	3.62	37.00	49.00
	Con	41.09	6.70	28.00	50.00
Modulation of movement affecting activity level	Exp	27.80	3.42	23.00	32.00
	Con	25.09	3.53	18.00	31.00
Modulation of sensory input affecting emotional responses	Exp	16.90	2.18	13.00	20.00
	Con	13.63	3.13	9.00	20.00
Modulation of visual input affecting emotional responses and activity level	Exp	16.40	3.02	10.00	20.00
	Con	14.90	3.23	9.00	19.00
Emotional /social responses	Exp	69.30	8.09	59.00	83.00
	Con	54.54	11.90	42.00	80.00
Behavioral outcomes of sensory processing	Exp	19.90	7.85	11.00	30.00
	Con	17.54	5.53	5.00	24.00
Items indicating thresholds	Exp	12.80	1.39	11.00	15.00
	Con	10.63	2.80	6.00	15.00

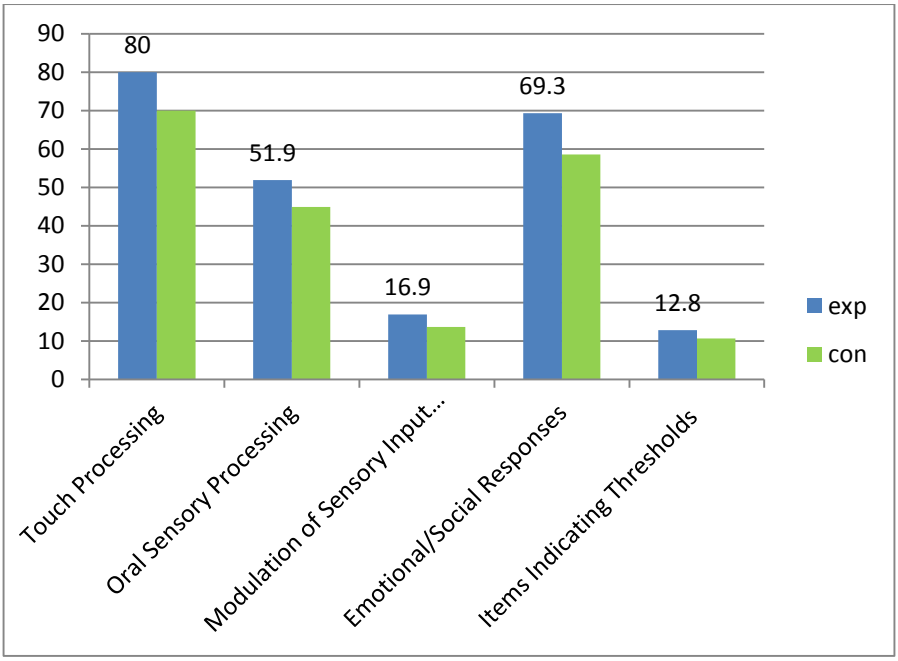
The above table shows descriptive statistic of sensory profile of section component of post test

Table 8.4 Comparison between Post Test Scores of Experimental and Control groups in Section Domain of SP

Section	Group	N	Mean rank	Sum of rank	U score	Sig (2tailed)
Auditory processing	Exp	10	11.00	110.00	55.00	1.00
	Con	11	11.00	121.00		
Visual processing	Exp	10	11.40	141.00	51.00	0.77
	Con	11	10.64	117.00		
Vestibular processing	Exp	10	13.45	134.50	30.50	0.08
	Con	11	8.77	96.50		
Touch processing	Exp	10	14.60	146.00	19.00	**0.01**
	Con	11	7.73	85 .00		
Multisensory processing	Exp	10	12.85	128.50	36.50	0.19
	Con	11	9.32	102.50		
Oral sensory sensitivity	Exp	10	14.25	142.50	22.50	**0.02**
	Con	11	8.05	88.50		
Sensory processing related to tone /endurance	Exp	10	12.75	127.50	37.50	0.20
	Con	11	9.41	103.50		
Modulation related to body position and movement	Exp	10	13.50	135.00	30.00	0.07
	Con	11	8.73	96.00		
Modulation of movement affecting activity level	Exp	10	13.10	131.00	34.00	0.13
	Con	11	9.09	100.00		
Modulation of sensory input affecting emotional responses	Exp	10	14.50	145.00	20.00	**0.01**
	Con	11	7.82	86.00		
Modulation of visual input affecting emotional responses and activity level	Exp	10	12.30	123.00	42.00	0.35
	Con	11	9.82	108.00		
Emotional /social responses	Exp	10	13.80	138.00	27.00	**0.04**
	Con	11	8.45	93.00		
Behavioral outcomes of sensory processing	Exp	10	11.90	119.00	46.00	0.52
	Con	11	10.18	112.00		
Items indicating thresholds	Exp	10	13.65	136.50	28.50	**0.05**
	Con	11	8.56	94.50		

The above table shows the 10 children in the post test experimental group (M =74.76,SD = 9.36) demonstrated a significant difference in touch processing, P is 0.01, oral sensory processing(M =48.23,SD= 7.29 demonstrated a significant difference ,P = 0.02 ,modulation of sensory input affecting emotional responses(M= 15.19,SD=3.14) with a significance of 0.01, emotional/social responses(M= 63.66,SD=11.42) with a significance of p= 0.04 and items indicating thresholds (M=11.66, SD= 2.45) with a significant value 0.05 as expected sensory integration therapy brings these variables to an optimum level.

Graph 8.1: Graphical Representation of Post Test scores of Sections in Experimental and Control group



Graph 8.1 shows the 10 children in the post test experimental group (M =74.76,SD = 9.36) demonstrated a significant difference in touch processing, P is 0.01, oral sensory processing(M =48.23,SD= 7.29 demonstrated a significant difference ,P = 0.02 ,modulation of sensory input affecting emotional responses(M= 15.19,SD=3.14) with a significance of 0.01, emotional/social responses(M= 63.66,SD=11.42) with a significance of p= 0.04 and items indicating thresholds (M=11.66, SD= 2.45) with a significant value 0.05 as expected sensory integration therapy brings these variables to an optimum level.

Table 8.5 Comparison of Components of Sections in SP within the Groups

Section	Group	Test	Posi-tive rank	Nega-tive rank	Ties	Z score	Sig (2tailed)
Auditory Processing	exp	Post - pre	9	0	1	-2.670	**0.00**
	con	Post - pre	2	4	5	-0.638	0.52
Visual Processing	exp	Post - pre	6	2	2	-1.827	0.06
	con	Post - pre	1	3	7	-0.552	0.58
Vestibular processing	exp	Post - pre	10	0	0	-2.807	**0.00**
	con	Post -pre	8	2	1	-1.674	0.09
Touch Processing	exp	Post -pre	8	1	1	-2.431	**0.01**
	con	Post -pre	8	3	0	-1.471	0.14
Multisensory Processing	exp	Post –pre	8	1	1	-2.077	**0.03**
	con	Post –pre	3	3	5	-0.527	0.59
Oral Sensory Processing	exp	Post –pre	9	0	1	-2.694	**0.00**
	con	Post –pre	2	2	7	-0.184	0.85
Sensory Processing Related to tone/endurance	exp	Post –pre	6	1	3	-2.117	**0.03**
	con	Post –pre	4	2	5	-0.105	0.91
Modulation Related to Body Position and Movement	exp	Post –pre	8	2	0	-2.051	**0.04**
	con	Post –pre	3	3	5	0.000	1.00
Modulation of Movement Affecting Activity Level	exp	Post –pre	9	1	0	-2.565	**0.01**
	con	Post –pre	3	3	5	-0.736	0.46
Modulation of Sensory Input Affecting Emotional Responses	exp	Post –pre	8	2	0	-2.102	**.036**
	con	Post –pre	3	4	4	-0.085	0.93
Modulation of Visual Input Affecting Emotional Responses and Activity Level	exp	Post –pre	8	1	1	-2.574	**.010**
	con	Post –pre	3	3	5	0.000	1.00
Emotional/Social Responses	Exp	Post –pre	8	2	0	-2.096	**0.03**
	Con	Post –pre	7	2	2	-1.008	0.31
Behavioral Outcomes of Sensory Processing	Exp	Post -pre	6	2	2	-1.689	0.09
	Con	Post -pre	3	5	3	-0.424	0.67
Items Indicating Thresholds	Exp	Post -pre	7	0	3	-2.414	**0.01**
	con	Post -pre	5	3	3	-1.211	0.22

The results shows that there is significant difference in the experimental group for Auditory Processing, Vestibular processing, Touch Processing, Oral Sensory Processing, Sensory Processing Related to tone/endurance, Modulation Related to Body Position and Movement, Modulation of Movement Affecting Activity Level, Modulation of Sensory Input Affecting Emotional Responses, Modulation of Visual Input Affecting Emotional Responses and Activity

Level, Emotional/Social Responses and Items Indicating Threshold. And there is no significant difference n any of the components in control group.

Table 9.1 Descriptive Statistic of sensory profile: factor component of pre test

Outcome measure	Group	mean	Std dev	min	max
Sensory seeking	experimental	64.72	10.12	52.00	82.00
	control	65.72	11.00	41.00	85.00
Low endurance or tone	experimental	39.90	6.23	24.00	45.00
	control	38.81	8.57	20.00	45.00
Oral sensory sensitivity	experimental	34.63	6.28	25.00	44.00
	control	34.45	6.47	24.00	45.00
Inattention/ distractibility	experimental	25.00	5.56	14.00	31.00
	control	26.27	4.60	16.00	32.00
Poor registration	experimental	31.36	6.91	20.00	39.00
	control	30.90	6.04	17.00	38.00
Sensory sensitivity	experimental	16.45	4.29	7.00	20.00
	control	16.45	3.53	11.00	20.00
Sedentary	experimental	14.36	5.51	4.00	20.00
	control	15.00	3.49	10.00	20.00
Fine motor/perceptual	experimental	7.00	3.71	3.00	15.00
	control	8.72	3.00	3.00	13.00

The above table shows descriptive statistic of factor component in sensory profile in pre test.

Table 9.2 Comparison between Pre Test Scores of Experimental and Control Groups on Components of Factor Domain in SP

Outcome measure	Group	N	Mean Rank	Sum of rank	U score	Sig(2tailed)
Sensory seeking	experimental	11	11.05	121.50	55.50	0.742
	control	11	11.95	131.50		
Low endurance or tone	experimental	11	11.14	122.50	56.50	0.788
	control	11	11.86	130.50		
Oral sensory sensitivity	experimental	11	11.36	125.00	59.00	0.921
	control	11	11.64	128.00		
Inattention/ distractibility	experimental	11	10.95	120.50	54.50	0.693
	control	11	12.05	132.50		
Poor registration	experimental	11	12.14	133.50	53.50	0.645
	control	11	10.86	119.50		
Sensory sensitivity	experimental	11	11.64	128.00	59.00	0.920
	control	11	11.36	125.00		
Sedentary	experimental	11	11.55	127.00	60.00	0.974
	control	11	11.45	126.00		
Fine motor/perceptual	experimental	11	9.59	105.50	39.50	0.164
	control	11	13.41	147.50		

The results shows there is no significant difference in the pre test scores of comparison between experimental and control group for factor domain. .This indicates that there is homogeneity of the group and thus post test score can be compared.

Table 9.3 Descriptive Statistic of sensory profile: factor component of post test

Outcome measure	Group	Mean	Std dev	Min	Max
Sensory seeking	experimental	71.10	5.66	61.00	77.00
	control	65.00	11.22	43.00	85.00
Low endurance or tone	experimental	44.20	4.26	39.00	55.00
	control	39.36	8.57	20.00	45.00
Oral sensory sensitivity	experimental	38.40	4.40	31.00	44.00
	control	33.81	6.67	24.00	45.00
Inattention/ distractibility	experimental	28.70	4.08	20.00	33.00
	control	25.81	4.93	15.00	32.00

Poor registration	experimental	36.20	3.64	30.00	40.00
	control	31.81	6.22	19.00	39.00
Sensory sensitivity	experimental	19.40	2.31	16.00	24.00
	control	16.72	3.87	11.00	20.00
Sedentary	experimental	17.60	2.06	14.00	20.00
	control	14.27	4.05	9.00	20.00
Fine motor/perceptual	experimental	10.10	5.08	4.00	19.00
	control	7.90	3.14	3.00	11.00

The above table shows the descriptive statistic of sensory profile among factor component of post test.

Table 9.4: Comparison between Post Test Scores of Experimental and Control Group on Components of Factor Domain in SP

Outcome measure	Group	N	Mean Rank	Sum of rank	U score	Sig(2tailed)
Sensory seeking	experimental	10	13.10	131.00	34.00	0.13
	control	11	9.09	100.00		
Low endurance or tone	experimental	10	12.05	120.50	44.50	0.44
	control	11	10.05	110.50		
Oral sensory sensitivity	experimental	10	13.45	134.50	30.50	0.08
	control	11	8.77	96.50		
Inattention/ distractibility	experimental	10	13.10	131.00	34.00	0.13
	control	11	9.09	100.00		
Poor registration	experimental	10	13.55	135.50	29.50	0.07
	control	11	8.68	95.50		
Sensory sensitivity	experimental	10	13.25	132.50	32.50	0.09
	control	10	8.95	98.50		
Sedentary	experimental	10	13.70	137.00	28.00	**0.05**
	control	11	8.55	94.00		
Fine motor/perceptual	experimental	10	12.25	122.50	42.50	0.37
	control	11	9.86	108.50		

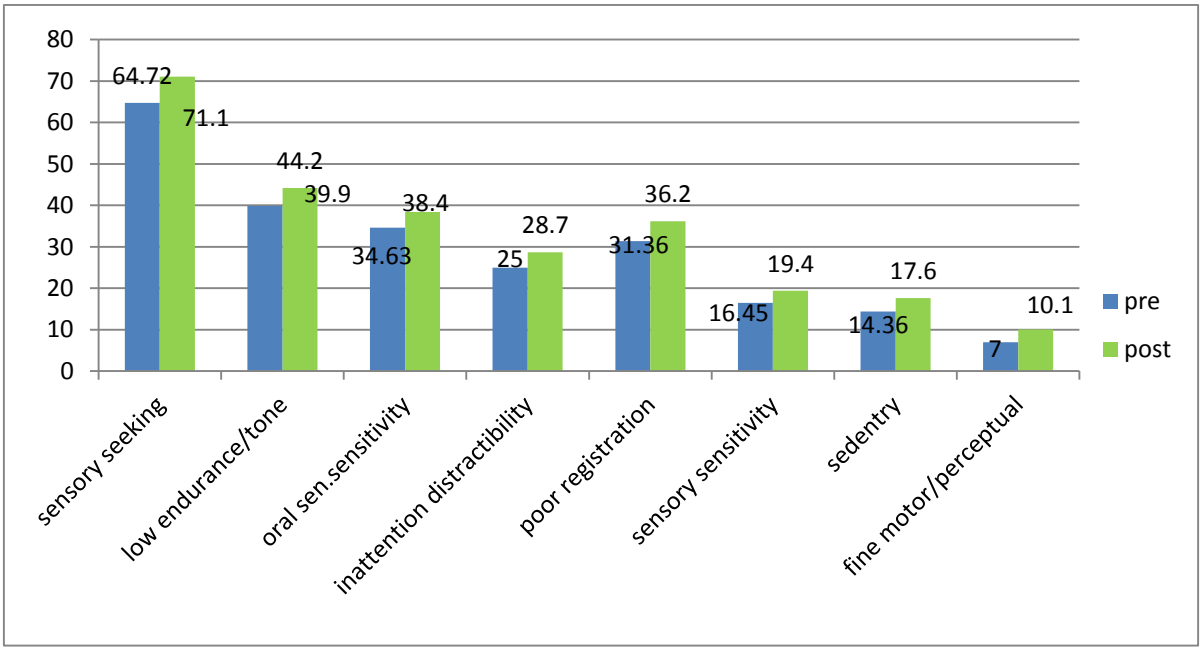
The above table shows there is significant difference in the post test of Sedentary component, P is 0.05 (=0.05).There is no other significant difference in any other component.

Table 9.5 Comparison of Components of Factor in SP within the Groups

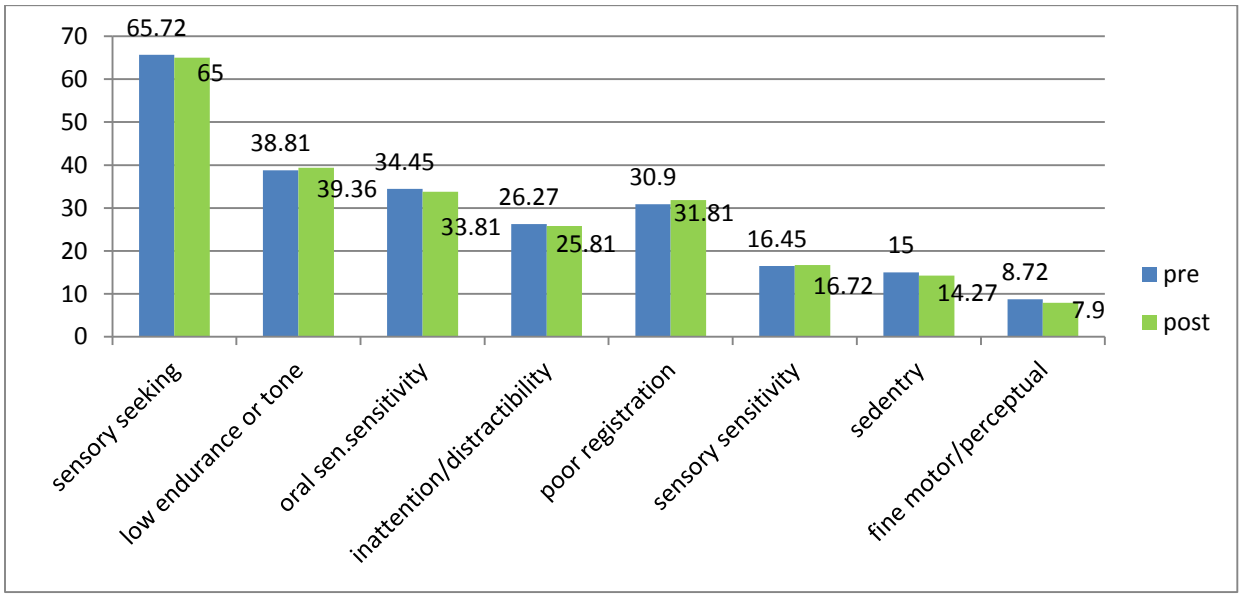
Factor	Group	Test	Posi-tive rank	Nega-tive rank	ties	Z score	Sig (2tailed)
Sensory seeking	Exp	Post -pre	8	2	0	-2.296	**0.02**
	Con	Post - pre	3	3	5	-0.318	0.75
Low endurance or tone	Exp	Post - pre	6	1	3	-2.117	**0.03**
	Con	Post - pre	3	0	8	-1.732	0.08
Oral sensory sensitivity	Exp	Post -pre	9	0	1	-2.677	**0.00**
	Con	Post - pre	0	4	7	-1.841	0.066
Inattention/ distractibility	Exp	Post - pre	10	0	0	-2.807	**0.00**
	Con	Post - pre	2	4	5	-1.186	0.236
Poor registration	Exp	Post -pre	9	0	1	-2.677	**0.00**
	Con	Post - pre	5	1	5	-2.049	**0.04**
Sensory sensitivity	Exp	Post - pre	7	1	2	-1.895	**0.05**
	Con	Post - pre	3	1	7	-1.134	0.257
Sedentary	Exp	Post -pre	7	2	1	-2.136	**0.03**
	Con	Post - pre	3	4	4	-0.768	0.44
Fine motor/perceptual	Exp	Post - pre	7	0	3	-2.375	**0.01**
	Con	Post - pre	1	5	5	-1.179	0.23

The results show that there is significant difference in all the components of factors in the experimental group and there is significant difference in control group for poor registration component.

Graph 9.1 Graphical representation of Comparison of Components of Factor in SP within the Experimental Group



Graph 9.2 Graphical representation of Comparison of Components of Factor in SP within the Control Group



The above graphs show that all the factor components in post test have improved in experimental group when compared with pre test and there is slight or no improvement in that of control group.

Table 9.6 Estimation of Effect size for experimental and group for poor registration

Variable	Mean		SD		Mean difference	Effect Size	t	df	Sig (2-tailed)
	Post	Pre	Post	Pre					
Poor registration exp	36.20	30.60	3.64	6.78	-5.6	0.457	-4.00	9	0.003
Poor registration con	31.81	30.90	6.22	6.04	-0.18	0.074	-2.31	10	0.043

Graph 9.3 Graphical Representation of Estimation of Effect size for experimental and group for poor registration

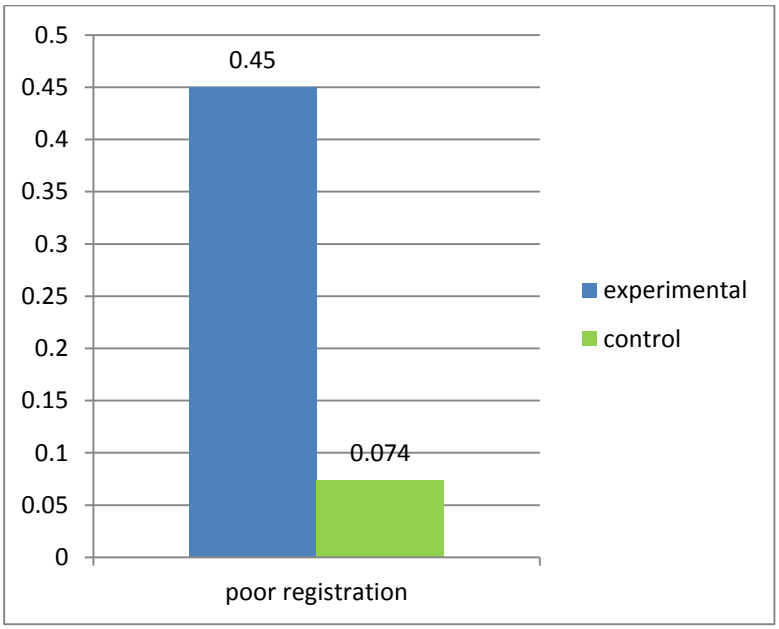


Table 9.6,Graph 9.3 shows that there is a small effect size for poor registration component of experimental and control group

Table 10.1 Descriptive Statistic of sensory profile: quadrant component of post test

Test	Outcome measure	Group	Mean	Std dev	Min	Max
Pretest	Registration	Exp	60.63	9.46	41.00	72.00
		Con	62.81	12.65	35.00	75.00
	Seeking	Exp	103.36	15.47	71.00	127.00
		Con	100.36	17.12	65.00	128.00
	Sensitivity	Exp	74.72	10.75	56.00	90.00
		Con	75.54	9.83	62.00	92.00
	Avoiding	Exp	112.00	15.01	89.00	132.00
		Con	108.36	16.54	76.00	131.00
Posttest	Registration	Exp	68.30	3.77	60.00	73.00
		Con	63.63	12.55	35.00	75.00
	Seeking	Exp	109.70	9.12	95.00	120.00
		Con	100.80	17.10	68.00	128.00
	Sensitivity	Exp	87.50	4.81	78.00	96.00
		Con	75.00	9.40	63.00	93.00
	Avoiding	Exp	125.90	9.78	105.00	142.00
		Con	108.72	18.28	79.00	136.00

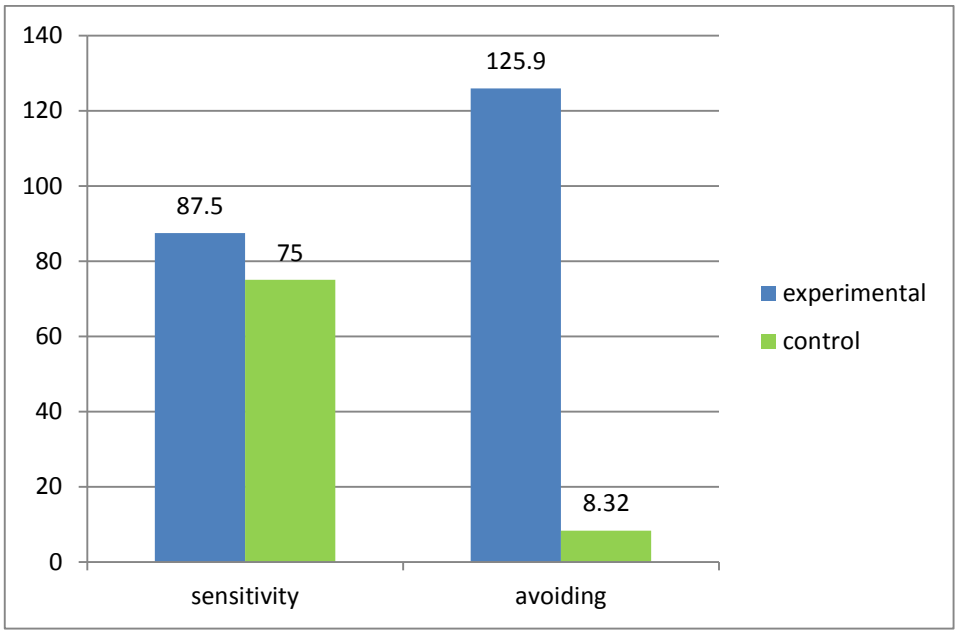
The above table shows descriptive statistic of sensory profile among the factor component of post test

Table 10.2: Comparison between pre and post test scores of experimental and control groups on components of quadrant domain in SP

Test	Outcome measure	Group	N	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pretest	Registration	experimental	11	10.27	113.00	47.00	0.37
		control	11	12.73	140.00		
	Seeking	experimental	11	11.91	131.00	56.00	0.76
		control	11	11.09	122.00		
	Sensitivity	experimental	11	11.82	130.00	57.00	0.81
		control	11	11.18	123.00		
	Avoiding	experimental	11	11.95	131.50	55.50	0.74
		control	11	11.05	121.50		
Posttest	Registration	experimental	10	11.05	110.50	54.50	0.97
		control	11	10.95	120.50		
	Seeking	experimental	10	12.85	128.50	36.50	0.19
		control	11	9.32	102.50		
	Sensitivity	experimental	10	15.15	151.50	13.50	**0.00**
		control	11	7.23	79.50		
	Avoiding	experimental	10	13.95	139.50	25.50	**0.03**
		control	11	8.32	91.50		

The above table shows no significant difference in the pretest of quadrant domain. This indicates that there is homogeneity of the group and thus post test scores can be compared. And there is significant difference for sensitivity (p= 0.00) and avoiding (p= 0.03), <0.05

Graph10.1 Graphical representation of post test scores of sensitivity and avoiding in experimental and control group



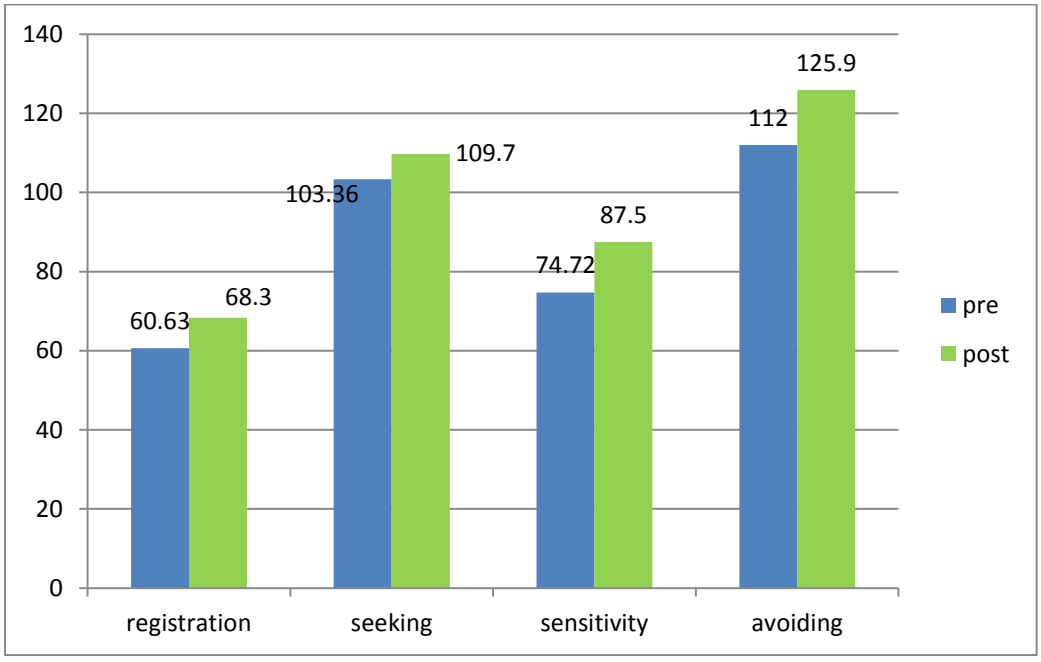
Graph 10.1 shows no significant difference in the pretest of quadrant domain. This indicates that there is homogeneity of the group and thus post test scores can be compared. And there is significant difference for sensitivity (p= 0.00) and avoiding (p= 0.03), <0.05

Table 10.3 Comparison of Pre Post Components of Quadrant in SP Within The Groups

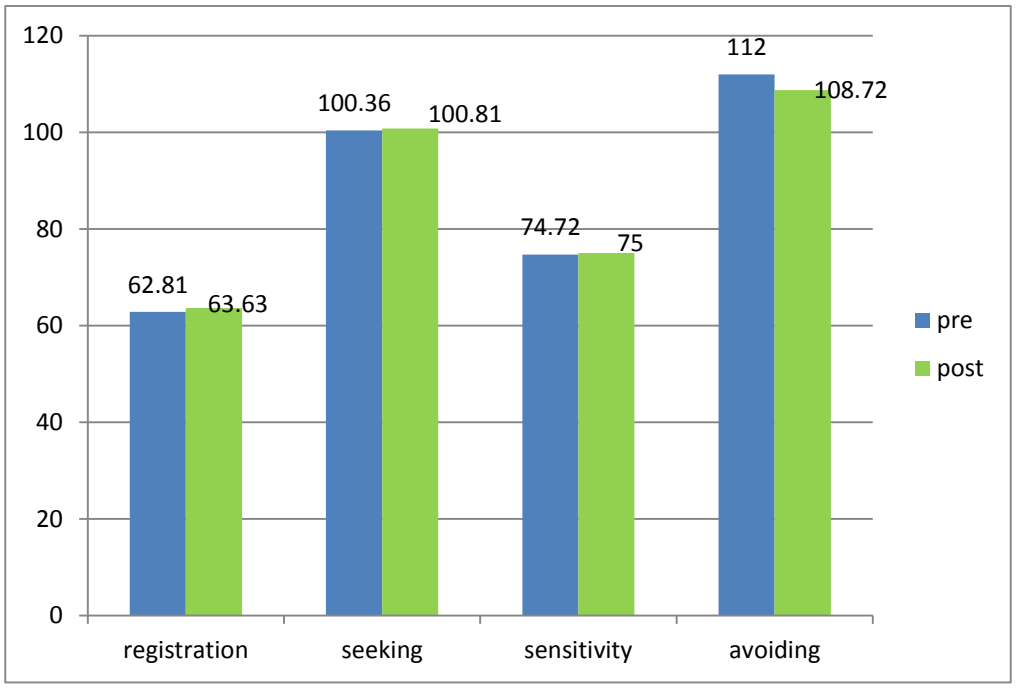
Domains	Group	Test	Positive rank	Negative rank	ties	Z score	Sig(2tailed)
Registration	Exp	Post - pre	10	0	0	-2.805	**0.005**
	Con	Post -pre	5	3	3	-1.199	0.230
Seeking	Exp	Post - pre	8	2	0	-1.988	**0.047**
	Con	Post - pre	6	4	1	-0.514	0.607
Sensitivity	Exp	Post - pre	10	0	0	-2.810	**0.005**
	Con	Post- prê	5	6	0	-0.733	0.463
Avoiding	Exp	Post - pre	9	1	0	-2.701	**0.007**
	Cont	Post- pre	7	4	0	-0.490	0.624

The results show that there is significant difference in all the components of quadrants in the experimental group.

Graph 10.2 Graphical Representation of Comparison of Pre Post Components of Quadrant in SP Within The experimental Group.



Graph 10.3 Graphical Representations of Comparison of Pre Post Components of Quadrant in SP Within The control Group



The above graphs show there is improvement in almost all the quadrants in experimental group where as there is no much change in comparison group.

Table 11.1 Toilet incidence frequency of experimental group during pre and posttest

Sl no	Experimental group					
	Pre test In toilet	Pre test Outside toilet	Total incidence (in 7 days)	Post test in toilet	Post outside toilet	Total incidence (in 7 days)
1	0	6	6	9	0	9
2	0	6	6	5	1	6
3	1	6	7	3	3	6
4	3	4	7	6	1	7
5	0	6	6	4	3	7
6	0	7	7	6	1	7
7	0	7	7	2	5	7
8	0	7	7	4	3	7
9	2	5	7	4	7	7
10	3	4	7	7	0	7
11	6	2	8	-	-	-

Table11.2 Toilet incidence frequency of control group **during pre and post test**

Sl No	Control Group					
	Pre test In toilet	Pre test Outside toilet	Total incidence (in 7 days)	Post test in toilet	Post outside toilet	Total incidence (in 7 days)
1	6	4	10	7	0	7
2	2	5	7	1	6	7
3	0	9	9	2	5	7
4	0	11	11	0	7	7
5	4	2	6	4	3	7
6	1	5	6	5	1	6
7	3	5	8	0	7	7
8	2	5	7	4	2	7
9	0	7	7	3	4	7
10	0	7	7	2	4	6
11	0	8	8	1	8	9

Table 11.1, 11.2 shows the frequency of defecation inside and outside the toilet of experimental and control group.

Table 12.1 odd ratio between pretest of the control and the experimental group based on the defecation inside the toilet and outside the toilet

Group	total no of defecation inside toilet	Ratio of defecation inside toilet	total no of defecation outside toilet	Ratio of defecation outside the toilet	odd's ratio(OD)
control	18	1: 0.83	68	1:3.77	1.058
experimental	15		60	1:3.33	

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The above table shows the odd ratio value 1.058 is greater than 1 it indicate the event is occur most likely in the control group, that mean the control group children defecate inside the toilet more than the experimental group

Table 12.2 odd ratio between posttest of the control and the experimental group based on the defecation inside the toilet and outside the toilet

Group	total no of defecation inside toilet	Ratio of defecation inside toilet	total no of defecation outside toilet	total no of defecation outside toilet	odd's ratio(OD)
Control	29	1:1.721	56	1:1.93	0.20
experimental	50		20	1:0.68	

The above table shows value 0.20 is lesser than 1 it indicate the event is occur less likely in the control group, that mean the control group children defecate inside the toilet less than experimental in the post test.

RESULTS

Table 1 shows this study consisted of 96 children with sensory processing children of whom 76 were boys and 20 were girls. The children age ranged from 3-10 year with a mean age of 5.10+_sd value 3.48

Table 2 and graph 2 shows Percentage of Children With and Without Toilet Skill Problems Among 96 SPDs, among them 68.75% had toilet skill problems and 31.25 didn't had toilet skill problem.

Table 3 shows percentage of section domain among SPD children having toilet skill problem.

Table 4 shows percentage of factor domain among SPD children having toilet skill problem.

Table 5 shows percentage of quadrant domain among SPD children having toilet skill problem.

Table 6 shows that there were 7 males and 3 girls in the experimental group and 9 boys and 2 girls in the control group. The mean age of experimental group was 3.72 ± .33 and that of control group was 4.22 ±1.22.

Table 7.1 The table shows the descriptive statistic of Canadian Occupational Performance Measure: performance and satisfaction component.

Table 7.2, Graph 7.1 shows that there is no significant differences in the pretest of the performance and satisfaction components; P is 0.92(>0.05) and 0.39(>0.05) respectively .This indicates that there is homogeneity of the group and thus post test score can be compared. There is significant differences in the post test of performance and satisfaction; P is 0.02(> 0.05) and 0.01(> 0.05).

Table 7.3: The results shows there is a significant difference in both experimental group and control group for performance and satisfaction components, P is 0.005(<0.05) for experimental group and P is 0.004(<0.05) for control group in for performance and satisfaction components respectively.

The rank values of experimental group shows 10 positive ranks and that of control group shows 10 positive and 1 negative ranks.

Table 7.4, Graph 7.2 The results show that there is a medium effect size for COPM components of experimental group. It also show that there is a small effect size for COPM components of control group.

Table 8.1 shows descriptive statistic of section component in SP during pretest.

Table 8.2 The results shows that there are no significant differences in the pre and post tests of components of sections in sensory profile, P is>0.05 .This indicates that there is homogeneity of the group and thus post test score can be compared.

Table 8.3 shows descriptive statistic of sensory profile of section component of post test.

Table 8.4,graph 8.1 shows the 10 children in the post test experimental group (M =74.76,SD = 9.36) demonstrated a significant difference in touch processing, P is 0.01, oral sensory processing(M =48.23,SD= 7.29 demonstrated a significant difference ,P = 0.02 ,modulation of sensory input affecting emotional responses(M= 15.19,SD=3.14) with a significance of 0.01, emotional/social responses(M= 63.66,SD=11.42) with a significance of p= 0.04 and items indicating thresholds (M=11.66, SD= 2.45) with a significant value 0.05 as expected sensory integration therapy brings these variables to an optimum level.

Table 8.5 :The results shows that there is significant difference in the experimental group for Auditory Processing, Vestibular processing, Touch Processing, Oral Sensory Processing, Sensory Processing Related to tone/endurance, Modulation Related to Body Position and Movement, Modulation of Movement Affecting Activity Level, Modulation of Sensory Input Affecting Emotional Responses, Modulation of Visual Input Affecting Emotional Responses and Activity Level, Emotional/Social Responses and Items Indicating Threshold. And there is no significant difference n any of the components in control group.

Table 9.1 shows descriptive statistic of factor component in sensory profile in pre test.

Table 9.2 the results shows there is no significant difference in the pre test scores of comparison between experimental and control group for factor domain. .This indicates that there is homogeneity of the group and thus post test score can be compared.

Table 9.3 The above table shows the descriptive statistic of sensory profile among factor component of post test.

Table 9.4 shows there is significant difference in the post test of Sedentary component, P is 0.05 (=0.05).There is no other significant difference in any other component.

Table 9.5 the results show that there is significant difference in all the components of factors in the experimental group and there is significant difference in control group for poor registration component.

Graph 9.1 & 9.2 show that all the factor components in post test have improved in experimental group when compared with pre test and there is slight or no improvement in that of control group.

Table 9.6, Graph 9.3 shows that there is a small effect size for poor registration component of experimental and control group.

Table 10.1 shows descriptive statistic of sensory profile among the factor component of post test.

Table 10.2 Graph 10.1, shows no significant difference in the pretest of quadrant domain. This indicates that there is homogeneity of the group and thus post test scores can be compared. And there is significant difference for sensitivity (p= 0.00) and avoiding (p= 0.03), <0.05

Table 10.3 The results show that there is significant difference in all the components of quadrants in the experimental group.

Graph 10.2 and 10.3 The above graphs show there is improvement in almost all the quadrants in experimental group where as there is no much change in comparison group.

Table 11.1, 11.2 shows the frequency of defecation inside and outside the toilet of experimental and control group.

Table 12.1 shows the odd ratio value 1.058 is greater than 1 it indicate the event is occur most likely in the control group, that mean the control group children defecate inside the toilet more than the experimental group.

Table 12.2 shows value 0.20 is lesser than 1 it indicate the event is occur less likely in the control group, that mean the control group children defecate inside the toilet less than experimental in the post test.

DISCUSSION

Prevalence of toilet skill problem in SPD

This study was conducted in different institutions in and around Coimbatore with SPD children. The phase 1of the study consisted of 96 children with sensory processing children of whom 76 were boys and 20 were girls. The children age ranged from 3-10 year with a mean age of 5.10+_sd value 3.48.they were assed using sensory profile, COPM and toilet chart to rule out sensory processing children with toilet skill problem.

This study sought to investigate whether toilet skill is prevalent in children with SPD. The findings of this study revealed the presence of 68.75% of SPD children with toilet skill problem. The study by Pollock,Metz and Barabash (2014) supports this finding, where they found out children with dysfunction elimination syndrome (53%) has SPD than was reported for general population.[3]

Section variable: (table 3)

Table 3 shows out of 96 SPD having toilet skill problem, 60.6 % have deviation in auditory processing, where as 39.9 showed typical performance in it. This result is in relation to the finding of Guthrie & Bryant that the auditory startle reflex is considered a measure of hyperarousal[9] and also Bakker and colleagues (2010) found that children with Irritable Bowel Syndrome (IBS) and functional abdominal pain syndrome demonstrated significantly greater auditory startle reflexes than a sample of typical children.[10]

There was no much difference in the percentage between total deviation and typical performance in visual processing among SPD children with toilet skill problems.47% and 53% respectively.

The table also shows a variation of 80.3%of total deviation in children for vestibular processing and only 20% of children had typical performance. The study by Beaudry and polo supports this finding that in most homes height of the toilet is not appropriate for young children and not having the feet in contact with the ground can cause insecurity and fear in children with vestibular hypersensitivity. [8]

In touch processing, there is not much difference in between the percentage of total deviation (48.5%) and typical performance (51.5%).this is in contrast to the study of Beaudry & Polo's that

Sensations such as those relating to anal distension, to be without clothes or sit on a toilet or a hard potty and cold can make defensive tactical child within uncomfortable. The common position adopted defecation stretches the skin of the anal area, which also it can cause discomfort.[8]

In multisensory processing, there were total deviations of 68.2 % and typical performance of 31.8 %

Sensory over-responsivity is well documented in children with feeding problems[2]. The classic study by Bellman (1966) documented a high prevalence of food refusal among children with fecal incontinence[30].In this study it is found out that out of 66 children with SPD and toilet skill problem, 58.5% shows a deviant behavior in oral sensory processing, where as 37.9% shows typical performance.

72.7% of children showed typical performance in sensory processing related to tone or endurance, this means there is no much relation with tone or endurance for toilet skill problems. Modulation related to body position and movement (53% deviant performance and 47% typical performance), modulation of movement affecting activity level (46.7% deviant performance and 53% typical performance) shows no much differences in their percentages.

In a study by Syed Rehan et.al shows fecal incontinence results in marked loss of self esteem in children. Parents who assume that fecal incontinence is an intentional behavior may become angry and aggressive, often resulting in disruption of the relationship between parents, as well as between parents and their children. These children often become very frightened as they are punished for something which the majority of them have no control over.[58]But components related to emotional and social responses (modulation of sensory input affecting emotional responses, modulation of visual input affecting emotional response and activity level,& emotional/social responses) doesn't show much differences in their percentage except modulation of visual input affecting emotional response and activity level.(deviant performance:62.12% and typical performance 37.9%).

There were 60.6% of deviant performance and 39.4 % of typical performance in behavioural outcomes of sensory processing. The prevalence of behavioral problems in children with constipation and fecal incontinence has been reported in several studies. There are many reports that children with constipation and fecal incontinence have more behavioral problems than typically developing children.[30, 33, and 44.]

In Items indicating threshold also there is not much difference in percentages (48.5 % deviant performance and 51.5% typical performance.)

Factors variable: (table 4)

Sensory seeking, oral sensory sensitivity, fine/perceptual components doesn't show much difference in percentages. But Ibrahim et al. (2009) found that the cumulative incidence of Constipation and feeding issues and/or food selectivity was significantly higher in children with autism relative to children in the control group. In low endurance/ tone factor, there were a total deviation of 33.3% and a typical deviation of 66.7%.

55.5% children fall in deviant performance category and 43.9 % shows typical performance in inattention /distractibility factor. This relates to the finding of Ahn, Miller, Milberger, & McIntosh that Sensory Processing is an important factor in considering a child's attention, memory, behavior, and function[38]. Therefore if sensory processing is disrupted, toileting may be problematic.[3]

Engaging in toileting tasks requires a person to tolerate and respond appropriately to a variety of sensory stimuli.[3]In contrast this study shows 54.5% of the children had typical performance while 45.5 % were deviant performance for factor poor registration.

44.94 % of children showed deviation in sensory sensensitivity factor,where as 54.5 % shows typical performance . Isabelle Beaudry (2015) found out that a group of children (n=16) with retentive fecal incontinence presented with significantly more behaviors related to sensory over-responsivity than a group of typically developing children (n=27).[2] An overall deviant behavior for sedentary was 59.1% and typical performance was 33.3 for children with SPD and toilet skill problems.

Quadrants:

Awareness of the need to void the bowel and bladder depends on processing of associated sensory stimuli[3]. This supports the finding that registration quadrant had a percentage of 56.1% total deviation and 43.9 % of typical performance among children with SPD and toilet skill problems.

In this study 62.5% of children showed deviant performance in seeking quadrant, where as 33.3 shows typical performance

77.2% of children had a deviant performance in Sensitivity and 62.1% had deviant performance in avoiding (table 5).This result relates to the study by Mazurek et al., showed Children with any type of gastrointestinal problem, including chronic constipation, had higher levels of sensory over-responsivity than children without such problems. The researchers found that sensory over-responsivity significantly contributed to the prediction of constipation, abdominal pain, nausea and bloating[7]. In a recent study it was reported that sensations such as those relating to anal distension, to be without clothes or sit on a toilet or a hard potty and cold can make defensive tactical child within uncomfortable. The common position adopted defecation stretches the skin of the anal area, which also it can cause discomfort.[2]

The auditory startle reflex is considered a measure of hyperarousal[9]. Bakker and colleagues found that children with Irritable Bowel Syndrome (IBS) and functional abdominal pain syndrome demonstrated significantly greater auditory startle reflexes than a sample of typical children[10]. The sounds are often amplified in the bathrooms, which can be a factor for the adjuvant alert level is increased and thus be one of the factor responsible for the rejection of children with auditory hypersensitivity be in the bathroom.[3] The authors consider that these results may provide evidence of a general hypersensitivity of the central nervous system among children with gastrointestinal disorders.

Most of the parents failed to return diet charts in survey as it is a one week schedule. When excluding the children who included in the phase 2 only 16 of the parents were able to return. Among them most of them did not have a toilet skill problem .Constipation for more than two days were seen in children without fiber intake and decreased water intake. A review of the efficacy of non-pharmalogical therapies for constipation concludes that current evidence related to increased fiber intake is weak.[59]

Effectiveness of sensory integration therapy on toilet skill development

The phase 2 of the study included 22 SPD children with toilet skill problem whom were randomly assigned from the phase 1. There were 8 males and 3 girls in the experimental group and 9 boys and 2 girls in the control group. The mean age of experimental group was 6.47 ±9.33 and that of

control group was 4.22 ±1.22 .The children in experimental group underwent regular occupational therapy with sensory integration therapy and those in control group received regular occupational therapy with behavior modification. Among the 11 children in the experimental group one discontinued the therapy and ceased coming for the therapy. Hence for the post test experimental N_1= 10, and control N_2 =11.

Since the experimental and the control group were divided according to the convenience, statistical analysis of groups for pretest was done and found to be non-significant. It indicates the homogeneity of the groups. Thus the groups were comparable after intervention period. (Table 7.2, table 7.4, table 9.2, table 10.2)

The effect of Sensory integration therapy on toilet skills was measured using COPM as toileting is one of the occupational performances.

There are RCTs (2006)and other studies[47,52] which shows behavior modification techniques improves toileting behavior of children with autism and other special needs. This is consistent with the results of this study, 88.54% of children included in this study with SPD had a diagnosis of autism. Table 8 shows significant difference in pre and posttests of both control and experimental group. Although Table 8 shows significant difference in the pre and posttests in both experimental and control group, which indicates changes in toilet skills, experimental group have improved more as the effect size of experimental group is more when compared with the control group (Table 7.4; graph 7.2).This correlates with the case study conducted by Beaudry (2014) which shows sensory integration therapy has an effect in toilet skill development in a child with fecal incontinence.[42]

Table 12.1 showed odd's ratio between pre test of control and experimental group based on defecation inside the toilet and outside the toilet. It shows the odd ratio value 1.05, which is greater than 1 which indicates, that the control group children defecate inside the toilet more than the experimental group.

Table 12.2 shows odd's ratio between post test of the control and experimental group based on defecating inside and outside the toilet. This table shows the odd ratio value 0.20 is lesser than1, indicating the event occurs less likely in control group. This means that the control group children defecate inside the toilet less than the experimental group in the post test. From the table 12.1 and

12.2, the ratio between the control and experimental group for defecation inside toilet is 1:0.83 and 1:1.72. Comparing the experimental group with control group (control group: experimental group) is clear that of defection inside toilet was 0.83 times prior to therapy, has increased to1.72 times after the therapy. This improvement in achievement of toilet skill in experimental group can be directly attributed to sensory integration therapy.

This finding is strongly supported by the result of case study done by Beaudry reports notable improvements in acquiring age-appropriate toileting habits were documented and measured using daily defecation logs. [42]

Toilet and Diet chart to measure the intake and output before and after the intervention:

All the parents of the included children filled and gave the toilet incidence chart (n= 22).The frequency of bowel accidents were measured with the toilet chart (table 11.1, 11.2). When scrutinizing the diet they followed, most of the children had a regular diet, which repeats very often and amount of non fibrous food was observed more often. Amount of water intake was very minimal for the children; say for an average of 3-4 glasses of water/day. These children had an irregular time and frequency of defecation which was mostly spontaneous and elimination is with urine. If the amount of defecation was very small a day, there were a high change of elimination at the second time. Milk was found one of the reason for multiple defecation a day for 50% of children. Mostly elimination is followed by a warm drink or food. There were absence of elimination when there was decreased amount of fluid intake or less fiber intake for most children and consumption of baked food (cake, busicuts,bread), where as some of them had none of these history for no elimination. Most of the children either soiled their pants or soiled outside when they are undressed. They showed very minimal readiness cue of facial expression and few didn't had readiness cue.

Diet/toilet charts for post test were able to collect from parents of both the groups except from the child in experimental group who discontinued the therapy. Most of the parents found fiber rich food was useful for their child's easy defecation. Almost all the parents followed a fiber rich food at least 4 times in a week after the diet awareness class.

For the experimental group children, the changes were noted on showing readiness cue from no readiness cue to pulling the parent to toilet/potty or removing dress most of the times. Those who had speech started verbalizing. Children were able to defecate most of the days but not in a regular time always.

For the control group, most of them achieved potty/toilet sitting tolerance even though they all were not toilet trained fully except a child.

Effectiveness of Sensory integration on SPD

Table 8.4,graph 8.1, shows comparison between the post test scores in section domains in which children showed significant difference in touch processing, oral sensory processing, modulation of sensory input affecting emotional responses, emotional/social responses, items indicating thresholds. And table11 infers there is change in most of the section domains. This finding is supported by Lane, Young, Baker & Angley, 2010. A combination of increased sensory processing difficulties, especially in the areas of taste & smell sensitivity and movement-related sensory behavior, was associated with greater challenge in self-care skills, adaptive behaviors and emotional regulations.[54]

Sensory modulation is the intake of sensation via typical sensory processing mechanisms such that the degree, intensity and quality of response are graded to match environmental demand and so that a range of optimal performance/adaptation is maintained[53]. SIT postulates that on controlled sensory input the children show adaptive responses. In the current study toilet skill is one of the adaptive responses which improved as the children had to accept different textures, food, and need to follow directions when sensory integration therapy was undergoing.

There is no significant difference in the pre test of factor domains in the sensory profile. P is (>0.05) .This indicates that there is homogeneity of group and post test scores can be compared.(table 9.2). Table 9.4 also shows no significant difference of factor domain in post test scores except for sedentary.

Comparison of factor components of experimental and control group after sensory integration therapy shows significant improvement in almost all components (Table 9.5).This is supported by the case study done by Roseann C. Schaaf, Kathleen McKeon Nightlinger(2007) which states that

“a child with poor sensory modulation and occupational performance deficits, and details improvements in occupational performance during sensory integration therapy”.

Table 9.6 shows the effect size of poor registration of both control and experimental group which shows a small effect size.(experimental group having much more small effect size than control group)

In Comparison between pre and post test scores on components of quadrant domain in the sensory profile (table 10.2),pre test indicates there is homogeneity of the groups and hence post test scores can be compared. And when post test scores were compared both sensitivity and avoiding shows significant difference. This shows there is homogeneity in the scores.

Table 10.3 shows there is significant difference in the experimental group for sensitivity and avoiding. This implies effectiveness in SIT for avoiding and sensitivity components. This is correlating to the case report by Winnie Dunn, 2007 which shows intervention in the child’s daily routines illustrate the impact on sensory processing for children with registration, seeking, sensitivity and avoiding problems.[56.] It is evident from Graph 10.2 and 10.3 that all the components in post test have improved in experimental group when compared with pretest of the same group; where as there is no change or decrease in improvement for the control group.

In summary, for the experimental group, sensory problems have decreased and toilet skills were improved due to regular and consistent sensory integration therapy for 4 months. For the control group, although toilet skill problems had improved after the intervention by behavior therapy their sensory issues haven’t come done. This can be due to irregular and inconsistent sensory integration therapy without prior proper sensory processing evaluation.

As toilet skills were developed in both in experimental and in control group, it is evident that the behavior therapy also has an effect in development of toilet skills. Hence a therapy in combination with both sensory integration therapy and behavior therapy for toilet skill development will be having a better outcome.

CONCLUSION

- The result of the study favored there is association between toilet skill problems and SPD.
- This study found out among 96 SPD children 68.75% had toilet skill problem.
- Sensory integration therapy also has an effect in toilet skill problems for children with SPD.
- As toilet scheduling is an important factor in development of appropriate toilet skills, treatment in combination with behavior modification and sensory integration therapy will be a better choice for children with SPD.

- Occupational therapists can teach Sensory integration therapy with behavior modification technique to the parents of children with SPD to attain age appropriate toilet skills.

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS:

- As the diet chart was for 7 days all the parents were unable to return the diet chat, only few were returned. Hence the information regarding diet was not generalized.
- The subjects for the intervention phase were assigned using purposive sampling and the size was too small to generalize the results.

- Involvement of mother is an important factor in maintaining diet and toilet chart. It was difficult to sort complete co-operation from mothers.

RECOMMENDATION:

- Further investigation should include large sample size.
- Correlation studies between toilet skill problems and sensory integration dysfunction.
- Comparison between three interventions (sensory integration, behavior modification, sensory integration + behavior modification) can be add an extensive knowledge into this area of research.

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CANADIAN OCCUPATIONAL PERFORMANCE MEASURE

Authors:
Mary Law, Sue Baptiste, Anne Carswell,
Mary Ann McColl, Helene Polatajko, Nancy Pollock

The Canadian Occupational Performance Measure (COPM) is an individualized measure designed for use by occupational therapists to detect self-perceived change in occupational performance problems over time.

Client Name:		
Age:	Gender:	ID#:
Respondent (if not client):		
Date of Assessment:	Planned Date of Reassessment:	Date of Reassessment:

Therapist:
Facility/Agency:
Program:

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STEP 1:
IDENTIFICATION OF OCCUPATIONAL PERFORMANCE ISSUES

To identify occupational performance problems, concerns and issues, interview the client, asking about daily activities in self-care, productivity and leisure. Ask clients to identify daily activities which they want to do, need to do or are expected to do by encouraging them to think about a typical day. Then ask the client to identify which of these activities are difficult for them to do now to their satisfaction. Record these activity problems in Steps 1A, 1B, or 1C.

STEP 2:
RATING IMPORTANCE

Using the scoring card provided, ask the client to rate, on a scale of 1 to 10, the importance of each activity. Place the ratings in the corresponding boxes in Steps 1A, 1B, or 1C.

STEP 1A: Self-care

IMPORTANCE

Personal Care
(e.g., dressing, bathing, feeding, hygiene)

_____ ☐
_____ ☐
_____ ☐

Functional Mobility
(e.g., transfers, indoor, outdoor)

_____ ☐
_____ ☐
_____ ☐

Community Management
(e.g., transportation, shopping, finances)

_____ ☐
_____ ☐
_____ ☐

STEP 1B: Productivity

Paid/Unpaid Work
(e.g., finding/keeping a job, volunteering)

_____ ☐
_____ ☐
_____ ☐

Household Management
(e.g., cleaning, laundry, cooking)

_____ ☐
_____ ☐
_____ ☐

Play/School
(e.g., play skills, homework)

_____ ☐
_____ ☐
_____ ☐

STEP 1C: Leisure

IMPORTANCE

Quiet Recreation
(e.g., hobbies, crafts, reading)

Active Recreation
(e.g., sports, outings, travel)

Socialization
(e.g., visiting, phone calls, parties, correspondence)

STEPS 3 & 4: SCORING - INITIAL ASSESSMENT and REASSESSMENT

Confirm with the client the 5 most important problems and record them below. Using the scoring cards, ask the client to rate each problem on performance and satisfaction, then calculate the total scores. Total scores are calculated by adding together the performance or satisfaction scores for all problems and dividing by the number of problems. At reassessment, the client scores each problem again for performance and satisfaction. Calculate the new scores and the change score.

Initial Assessment:

Reassessment:

OCCUPATIONAL PERFORMANCE PROBLEMS:	PERFORMANCE 1	SATISFACTION 1	PERFORMANCE 2	SATISFACTION 2
1.				
2.				
3.				
4.				
5.				

SCORING:

Total score = Total performance or satisfaction scores / # of problems

PERFORMANCE SCORE 1	SATISFACTION SCORE 1	PERFORMANCE SCORE 2	SATISFACTION SCORE 2
/ =	/ =	/ =	/ =

CHANGE IN PERFORMANCE = Performance Score 2 – Performance Score 1 =

CHANGE IN SATISFACTION = Satisfaction Score 2 – Satisfaction Score 1 =

ADDITIONAL NOTES AND BACKGROUND INFORMATION

Initial Assessment:

Reassessment:

SENSORY PROFILE

Winnie Dunn, Ph.D., OTR, FAOTA

Caregiver Questionnaire

Child's Name: _____ Birth Date: _____ Date: _____

Completed by: _____ Relationship to Child: _____

Service Provider's Name: _____ Discipline: _____

INSTRUCTIONS

Please check the box that **best** describes the frequency with which your child does the following behaviors. Please answer all of the statements. If you are unable to comment because you have not observed the behavior or believe that it does not apply to your child, please draw an X through the number for that item. Write any comments at the end of each section. Please do not write in the Section Raw Score Total row.

Use the following key to mark your responses:

ALWAYS	When presented with the opportunity, your child always responds in this manner, 100% of the time.
FREQUENTLY	When presented with the opportunity, your child frequently responds in this manner, about 75% of the time.
OCCASIONALLY	When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time.
SELDOM	When presented with the opportunity, your child seldom responds in this manner, about 25% of the time.
NEVER	When presented with the opportunity, your child never responds in this manner, 0% of the time.

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Sensory Processing

Item			A. Auditory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	1	Responds negatively to unexpected or loud noises (for example, cries or hides at noise from vacuum cleaner, dog barking, hair dryer)					
	L	2	Holds hands over ears to protect ears from sound					
	L	3	Has trouble completing tasks when the radio is on					
	L	4	Is distracted or has trouble functioning if there is a lot of noise around					
	L	5	Can't work with background noise (for example, fan, refrigerator)					
	H	6	Appears to not hear what you say (for example, does not "tune-in" to what you say, appears to ignore you)					
	H	7	Doesn't respond when name is called but you know the child's hearing is OK					
	H	8	Enjoys strange noises/seeks to make noise for noise's sake					
			Section Raw Score Total					

Comments

Item			B. Visual Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	9	Prefers to be in the dark					
	L	10	Expresses discomfort with or avoids bright lights (for example, hides from sunlight through window in car)					
	L	11	Happy to be in the dark					
	L	12	Becomes frustrated when trying to find objects in competing backgrounds (for example, a cluttered drawer)					
	L	13	Has difficulty putting puzzles together (as compared to same age children)					
	L	14	Is bothered by bright lights after others have adapted to the light					
	L	15	Covers eyes or squints to protect eyes from light					
	H	16	Looks carefully or intensely at objects/people (for example, stares)					
	H	17	Has a hard time finding objects in competing backgrounds (for example, shoes in a messy room, favorite toy in the "junk drawer")					
			Section Raw Score Total					

Comments

Item			C. Vestibular Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
→	L	18	Becomes anxious or distressed when feet leave the ground					
→	L	19	Dislikes activities where head is upside down (for example, somersaults, roughhousing)					
→	L	20	Avoids playground equipment or moving toys (for example, swing set, merry-go-round)					
→	L	21	Dislikes riding in a car					
→	L	22	Holds head upright, even when bending over or leaning (for example, maintains a rigid position/posture during activity)					
→	L	23	Becomes disoriented after bending over sink or table (for example, falls or gets dizzy)					
→	H	24	Seeks all kinds of movement and this interferes with daily routines (for example, can't sit still, fidgets)					
→	H	25	Seeks out all kinds of movement activities (for example, being whirled by adult, merry-go-rounds, playground equipment, moving toys)					
→	H	26	Twirls/spins self frequently throughout the day (for example, likes dizzy feeling)					
→	H	27	Rocks unconsciously (for example, while watching TV)					
→	H	28	Rocks in desk/chair/on floor					
			Section Raw Score Total					

Comments

Item			D. Touch Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	29	Avoids getting "messy" (for example, in paste, sand, finger paint, glue, tape)					
	L	30	Expresses distress during grooming (for example, fights or cries during haircutting, face washing, fingernail cutting)					
	L	31	Prefers long-sleeved clothing when it is warm or short sleeves when it is cold					
	L	32	Expresses discomfort at dental work or toothbrushing (for example, cries or fights)					
	L	33	Is sensitive to certain fabrics (for example, is particular about certain clothes or bedsheets)					
	L	34	Becomes irritated by shoes or socks					
	L	35	Avoids going barefoot, especially in sand or grass					
	L	36	Reacts emotionally or aggressively to touch					
	L	37	Withdraws from splashing water					
	L	38	Has difficulty standing in line or close to other people					
	L	39	Rubs or scratches out a spot that has been touched					
	H	40	Touches people and objects to the point of irritating others					
	H	41	Displays unusual need for touching certain toys, surfaces, or textures (for example, constantly touching objects)					
	H	42	Decreased awareness of pain and temperature					
	H	43	Doesn't seem to notice when someone touches arm or back (for example, unaware)					
	H	44	Avoids wearing shoes; loves to be barefoot					
	H	45	Touches people and objects					
	H	46	Doesn't seem to notice when face or hands are messy					
			Section Raw Score Total					

Comments

Item			E. Multisensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		47	Gets lost easily (even in familiar places)					
		48	Has difficulty paying attention					
	L	49	Looks away from tasks to notice all actions in the room					
	H	50	Seems oblivious within an active environment (for example, unaware of activity)					
	H	51	Hangs on people, furniture, or objects even in familiar situations					
	H	52	Walks on toes					
	H	53	Leaves clothing twisted on body					
			Section Raw Score Total					

Comments

Item			F. Oral Sensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	54	Gags easily with food textures or food utensils in mouth					
	L	55	Avoids certain tastes or food smells that are typically part of children's diets					
	L	56	Will only eat certain tastes (list:)					
	L	57	Limits self to particular food textures/temperatures (list:)					
	L	58	Picky eater, especially regarding food textures					
	H	59	Routinely smells nonfood objects					
	H	60	Shows strong preference for certain smells (list:)					
	H	61	Shows strong preference for certain tastes (list:)					
	H	62	Craves certain foods (list:)					
	H	63	Seeks out certain tastes or smells (list:)					
	H	64	Chews or licks on nonfood objects					
	H	65	Mouths objects (for example, pencil, hands)					
			Section Raw Score Total					

Comments

Modulation

Item			G. Sensory Processing Related to Endurance/Tone	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		66	Moves stiffly					
	H	67	Tires easily, especially when standing or holding particular body position					
	H	68	Locks joints (for example, elbows, knees) for stability					
	H	69	Seems to have weak muscles					
	H	70	Has a weak grasp					
	H	71	Can't lift heavy objects (for example, weak in comparison to same age children)					
	H	72	Props to support self (even during activity)					
→	H	73	Poor endurance/tires easily					
→	H	74	Appears lethargic (for example, has no energy, is sluggish)					
			Section Raw Score Total					

Comments

Item			H. Modulation Related to Body Position and Movement	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		75	Seems accident-prone					
		76	Hesitates going up or down curbs or steps (for example, is cautious, stops before moving)					
	L	77	Fears falling or heights					
	L	78	Avoids climbing/jumping or avoids bumpy/uneven ground					
	L	79	Holds onto walls or banisters (for example, clings)					
	H	80	Takes excessive risks during play (for example, climbs high into a tree, jumps off tall furniture)					
	H	81	Takes movement or climbing risks during play that compromise personal safety					
	H	82	Turns whole body to look at you					
	H	83	Seeks opportunities to fall without regard to personal safety					
	H	84	Appears to enjoy falling					
			Section Raw Score Total					

Comments

Item			I. Modulation of Movement Affecting Activity Level	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	85	Spends most of the day in sedentary play (for example, does quiet things)					
	L	86	Prefers quiet, sedentary play (for example, watching TV, books, computers)					
	L	87	Seeks sedentary play options					
	L	88	Prefers sedentary activities					
	H	89	Becomes overly excitable during movement activity					
	H	90	"On the go"					
	H	91	Avoids quiet play activities					
			Section Raw Score Total					

Comments

Item			J. Modulation of Sensory Input Affecting Emotional Responses	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		92	Needs more protection from life than other children (for example, defenseless physically or emotionally)					
	L	93	Rigid rituals in personal hygiene					
	H	94	Is overly affectionate with others					
	H	95	Doesn't perceive body language or facial expressions (for example, unable to interpret)					
			Section Raw Score Total					

Comments

Item			K. Modulation of Visual Input Affecting Emotional Responses and Activity Level	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
👁	L	96	Avoids eye contact					
👁	H	97	Stares intensively at objects or people					
👁	H	98	Watches everyone when they move around the room					
👁	H	99	Doesn't notice when people come into the room					
			Section Raw Score Total					

Comments

Behavior and Emotional Responses

Item			L. Emotional/Social Responses	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
♡		100	Seems to have difficulty liking self (for example, low self-esteem)					
♡		101	Has trouble "growing up" (for example, reacts immaturely to situations)					
♡		102	Is sensitive to criticisms					
♡		103	Has definite fears (for example, fears are predictable)					
♡		104	Seems anxious					
♡		105	Displays excessive emotional outbursts when unsuccessful at a task					
♡		106	Expresses feeling like a failure					
♡		107	Is stubborn or uncooperative					
♡		108	Has temper tantrums					
♡		109	Poor frustration tolerance					
♡		110	Cries easily					
♡		111	Overly serious					
♡		112	Has difficulty making friends (for example, does not interact or participate in group play)					
♡		113	Has nightmares					
♡		114	Has fears that interfere with daily routine					
♡		115	Doesn't have a sense of humor					
♡		116	Doesn't express emotions					
			Section Raw Score Total					

Comments

Item			M. Behavioral Outcomes of Sensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		117	Talks self through tasks					
		118	Writing is illegible					
		119	Has trouble staying between the lines when coloring or when writing					
		120	Uses inefficient ways of doing things (for example, wastes time, moves slowly, does things a harder way than is needed)					
	L	121	Has difficulty tolerating changes in plans and expectations					
	L	122	Has difficulty tolerating changes in routines					
			Section Raw Score Total					

Comments

Item			N. Items Indicating Thresholds for Response	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		123	Jumps from one activity to another so that it interferes with play					
	H	124	Deliberately smells objects					
	H	125	Does not seem to smell strong odors					
			Section Raw Score Total					

Comments

FOR OFFICE USE ONLY

ICON KEY	
	Auditory
	Visual
	Activity Level
	Taste/Smell
	Body Position
	Movement
	Touch
	Emotional/Social

THRESHOLD KEY	
	Neither low nor high
L	Low
H	High

SCORE KEY	
1	Always
2	Frequently
3	Occasionally
4	Seldom
5	Never

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DATE	TIME	ITEM	QUANTITY	TIME	INTUCED / SPONTANEOUS	ELIMINATION ONLY DEFECATION / WITH URINE	QUANTITY	INPANT / TOILET / OUTSIDE TOILET	READINESS CUE BEFORE / ARTER / NIL	WHAT READINESS CUE
தேதி	மணி	உணவு பொருள்	அளவு	நேரம்	தானாகவே / முயற்சியேரு	மோஷன் மட்டும் / சிறுநீருடன் போதல்	அளவு	துணியில் போதல் / கழிவறையில் வெளியே	தயாராகுதல் முன்பு / பின்பு / இல்லை	எப்படி தயாராகிறான் 1. முகத்தில் காட்டுதல் 2.அழுதல் 3.தன்னை மறைத்தல் 4. கழிவறை நோக்கி போதல் / போட்டி சேர் / 5.துணி கழட்டுதல் 6.கழிவறை நோக்குதல் / போட்டிசேர் நோக்குதல் 7.வார்த்தையால் கூறுதல் 8.வேறு ஏதேனும் (குறிப்பிடுக)

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Ref :

Date : 10.3.2017

This is to certify Miss. Nikhila Mary koshy. MOT. IInd year KMCH college of Occupational therapy, Conducted her study in our centre on "A Study to identify prevalance and effectiveness of Sensory Integration as Toilet skill problems amay Sensory Processing disorder.

During her study she was Sincere and regular.

Menaka. T.

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Daisy Swapna M.O.T.,
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Reg. No. : 3256/06

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SHRIANO THERAPY CENTRE

Date : 15.3.2017

TO WHOMSOEVER IT MAY CONCERN

This is to certify Miss. Nikhila Mary Koshy of MOT IInd year, KMCH College of occupational therapy, conducted her data collection regarding her study on "A study to identify prevalence and effectiveness of Sensory Integration as Toilet skill problems among Sensory Processing disorder", in our centre.

During her study she was sincere and regular. I wish her all the best.

DAISY SWAPNA. M.O.T.,

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KAUMARAM
PRASHANTHI ACADEMY
(Run by Kaumaram Prashanthi Trust)

Date: 20.3.17

To whomsoever it may concern

This is to certify that **Miss. NIKHILA MARY KOSHY**, MOT II Year, KMCH College of Occupational Therapy, conducted her study on "A Study to Identify Prevalence and Effectiveness of sensory integration on toilet skill problems among sensory processing disorder" in our Organization.

Mrs. Deepa Mohanraj, M.Sc.Psy
DIRECTOR
Kaumaram Prashanthi Academy
(A School For Children With Special Needs)
Director

239/2, Chinnavedampatti Post, Coimbatore - 641 049.
Phone : +91 96593 05550 www.kaumaramprashanthiacademy.org www.kaumaramprashanthitrust.org

Parental Consent form

I am ~~Mr.~~/Mrs/~~Miss~~ Suji P.V

I have been provided with all the details and information regarding the study "Effectiveness of sensory integration on toilet skill development among children with Sensory Processing Disorder"

As parent or legal guardian, I authorize HARINI. P.V (child's name) to become a participant in the research study described in this form.

DATE: 1.10.2016 DATE:

Signature of the researcher: **Signature of the parent:**

Parental Consent form

I am Mr./Mrs/~~Miss~~ Rekha.

I have been provided with all the details and information regarding the study "Effectiveness of sensory integration on toilet skill development among children with Sensory Processing Disorder"

As parent or legal guardian, I authorize Athulk. S (child's name) to become a participant in the research study described in this form.

DATE: 1.10.2016 DATE:

Signature of the researcher: **Signature of the parent:**

Parental Consent form

I am Mr./~~Mrs/Miss~~ V. R Suresh

I have been provided with all the details and information regarding the study "Effectiveness of sensory integration on toilet skill development among children with Sensory Processing Disorder"

As parent or legal guardian, I authorize S. Sanjeev Krishna (child's name) to become a participant in the research study described in this form.

DATE: 1.10.2016 DATE:

Signature of the researcher: **Signature of the parent:**

KMCH ETHICS COMMITTEE
KOVAI MEDICAL CENTER AND HOSPITAL LIMITED

Post Box No. 3209, Avanashi Road, Coimbatore - 641 014. INDIA
✆ : (0422) 4323800, 4323619 Fax : (0422) 4270805
E-mail : ethics@kmchhospitals.com
EC Reg. No : ECR / 112 / Inst / TN / 2013

Ref: EC/AP/509/02/2017
13.02.2017

To
Mrs.S.Sugi MOT (Pediatrics)
Professor
KMCH college of Occupational Therapy
KMCH Campus, Avinashi Road
Coimbatore-641 014

Dear Mrs.S.Sugi,

The proposal entitled **"A Study to Identify Prevalence and Effectiveness of Sensory Integration on Toilet skill problems among Sensory Processing Disorder"** Submitted by **Ms.Nikhila Mary Koshy,** under your guidance was reviewed by the Ethics Committee in its meeting held on 11.02.2017 and permission is granted to carry out the study at Kovai Medical Center and Hospital Ltd, Coimbatore, India.

Thanking you,

Yours faithfully,

Dr. P. R. Muthuswamy
Chairman, KMCH Ethics Committee

Dr. P. R. MUTHUSWAMY,
MA.,MBA. FDPM(IIM-A)Ph.D.
Chairman
Ethics Committee
Kovai Medical Center and Hospital
Avanashi Road,
COIMBATORE-641 014.

Copy to: Clinical guide:
Dr.K.Rajendran, M.D(paed)
Consultant Paediatrician and Neonatologist
Kovai Medical Center and Hospital

JEWEL
AUTISM CENTRE

A multispeciality therapy clinic for children with behavioural impairments

- Occupational Therapy
- Speech Therapy
- Sensory Integration Therapy
- Behavioral Therapy
- Remedial Education programme
- Play Therapy
- Social skills Training programme

To whomsoever it may concern

This is to inform you that permission is granted to Ms. Nikhila Mary Koshy for carrying out her project work in our centre as per her convenience.

Dr. Toney Bleson
Joint Director

Kottayam
24/10/2016.

JEWEL AUTISM CENTRE KOTTAYAM PIN-686 001

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